Water Quality Assessment of Non-Project Turn-ins to the California Aqueduct, 2012

Technical Memorandum Report

State of California
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DEPARTMENT OF WATER RESOURCES

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Cover:
Kern River alluvial fan area is used for groundwater recharge, banking, and recovery programs. The Cross Valley Canal and Kern Water Bank Canal can import water from the State Water Project's California Aqueduct for percolation and storage in years of water supply availability. Flow in both canals can be reversed to convey extracted groundwater to the California Aqueduct for the benefit of project participants. Areas of ponded water for percolation and recharge can be seen in this 2011 photo (source: adapted from Google Earth, downloaded 1/23/2013).

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Acronyms and Abbreviations

µg/L	micrograms per liter
µS/cm	micro Siemens per centimeter
AEWSD	Arvin-Edison Water Storage District
af	acre-foot, acre-feet
Aqueduct	Edmond G. Brown California Aqueduct
Bryte Lab	Bryte Chemical Laboratory
cfs	cubic feet per second
COC	constituents-of-concern
CVC	Cross Valley Canal
DOC	dissolved organic carbon
DPH	California Department of Public Health
DWR	California Department of Water Resources
KCWA	Kern County Water Agency
KWBA	Kern Water Bank Authority
KWBC	Kern Water Bank Canal
MCL	maximum contaminant level
mg/L	mg/L
MP	Mile Post: distance in miles down the California Aqueduct from the northernmost feature at the Clifton Court Forebay Gates
OEHHA	Office of Environmental Health Hazard Assessment
PHG	Public Health Goal
SLC	San Luis Canal: segment of the California Aqueduct that is part of the Joint-Use Facilities
SLWD	San Luis Water District
SWP	State Water Project
TDS	total dissolved solids
TOC	total organic carbon
us/ds	upstream/downstream
WRMWSD	Wheeler Ridge-Maricopa Water Storage District
WWD	Westlands Water District

I. Summary

Non-Project turn-in waters were admitted to the State Water Project's Edmond G. Brown California Aqueduct (Aqueduct) in the San Joaquin and San Luis Field Divisions during 2012. These waters, called turn-ins, originate from sources outside of the Sacramento-San Joaquin Delta (Delta). Turn-in volumes were largest in the San Joaquin Field Division and originated as groundwater. Turn-ins volumes were much smaller in the San Luis Field Division and included flood flows from the Kings River and groundwater. Water samples collected during the turn-in periods showed that effects on Aqueduct water quality were often not consistent and dependent on a variety of factors such as turn-in source and relative flows.

San Joaquin Field Division

Turn-ins to the Aqueduct in the San Joaquin Field Division occurred during two separate periods in 2012: March-June and December. Turn-ins were greatest March through June, when approximately 119,335 acre-feet (af) of groundwater was admitted to the Aqueduct from several sources. The largest volume originated from the Kern Water Bank Canal (KWBC) with 79.6% of the total, followed by the Cross Valley Canal (CVC) with 10.9%, Arvin-Edison Water Storage District (AEWSD) with 8.4%, and Wheeler Ridge-Maricopa Water Storage District (WRMWSD) with 1.1% (combined from several turn-in locations). Total monthly inflow volumes from CVC + KWBC relative to Aqueduct flow-volumes (percent-of-Aqueduct or dilution factors in percentage) were highest in March and April (39.8 and 26.2%, respectively) and lowest during May and June (10.0 and 9.3%, respectively) with an overall dilution factor of 17.1% for the four-month period. Farther downstream, dilution factors from AEWSD and/or WRMWSD inflows ranged from 0.22% (May) to 7.5% (March).

Changes in Aqueduct water quality from CVC + KWBC during March through June were assessed with upstream/downstream (us/ds) same-day sampling at Checks 27 and 29 which bracketed the turn-ins within 12.8 miles. Constituents-of-concern (COCs) included arsenic, bromide, conductivity, dissolved organic carbon (DOC), nitrate, sulfate, and total dissolved solids (TDS). A limited number of chromium (total and hexavalent) samples were also collected. Changes in us/ds concentrations were largely attributable to the turn-ins, even though, based on certain observed trends, other factors were presumed to have influenced the findings. These factors included downstream migrating segments of differing water quality and laboratory method precision. None of the COCs exceeded existing drinking water maximum contaminant levels (MCLs) in the Aqueduct.

Generally, nitrate and, to a less consistent extent, arsenic increased downstream of the CVC + KWBC turn-ins. Conversely, decreases were consistently observed for DOC and less consistently for salinity and bromide. Sulfate declined when upstream levels were highest and increased when upstream levels were lowest. Below are the specific COC findings.

- Arsenic was unchanged on four sample dates and increased by 0.0005 to 0.001 milligrams per liter (mg/L) on three dates.
- No change, or relatively slight decreases (averaging 0.02 mg/L), in Aqueduct bromide were observed.
- Aqueduct conductivity was reduced during April (by up to 72.5 micro Siemens per centimeter [µS/cm]) with relatively little or no change during remainder of the turn-in period.
- DOC consistently decreased by 0.2 to 1.1 mg/L, with an average decline of 0.7 mg/L during the turn-in period.
- Nitrate consistently increased by 0.2 to 1.6 mg/L, with an average increase of 0.9 mg/L during the turn-in period.
- Sulfate increased by 1 to 3 mg/L on four dates and decreased by 1 to 8 mg/L on three dates. The changes were controlled by upstream Aqueduct concentrations; increases occurred when upstream levels were $\leq$ 37 mg/L and decreases occurred when upstream levels were $\geq$ 50 mg/L.
- TDS generally exhibited the same trends as conductivity.

Farther downstream, turn-ins from AEWSD + WRMWSD were assessed with us/ds same-day sampling at Checks 29 and 39 which bracketed the turn-ins within 45.7 miles. The observed water quality changes can be less confidently attributed entirely to the turn-ins owing to the low dilution factors (0.22 to 7.5%) and the relatively long intervening distance between us/ds stations (45.7 miles). This makes the analysis more prone to effects from factors such as downstream migrating segments of changing water quality.

Instances when bromide, conductivity, and sulfate decreased and nitrate increased suggested influence by AEWSD based on relative water quality. Several WRMWSD wells exhibited some of the highest concentrations of various COCs and may have been responsible for certain observed increases. DOC declined in most us/ds sample pairs. Below are the specific COC findings.

- Arsenic was unchanged on four sample dates and increased by 0.0005 and 0.001 mg/L on two dates.
- Bromide decreased by 0.01 to 0.05 mg/L on three dates, was unchanged on two dates, and increased by 0.03 mg/L on one date.

- Conductivity increased by 9 to 35 µS/cm on four dates and decreased by 6.5 and 61 µS/cm on two dates.
- DOC decreased by 0.2 to 1.1 mg/L on five dates and increased by 0.3 mg/L on one date.
- Nitrate increased by 0.4 to 0.9 mg/L on four dates and decreased by 0.1 and 1.4 mg/L on two dates.
- Sulfate decreased by 1.5 to 5 mg/L on three dates, increased by 6 mg/L on two dates, and was unchanged on one date.
- TDS generally exhibited the same trends as conductivity.

Turn-ins from KWBC were re-initiated on December 7, at a flow rate of 310 cubic feet per second (cfs). A total of 14,395 af was admitted to the Aqueduct, composing 19.7% of the flow-volume that month. COCs in KWBC were similar to, or below, background levels in the Aqueduct with the exception of hexavalent chromium, nitrate, sulfate, and, to a certain extent, salinity. Hexavalent chromium increased in the Aqueduct from one pair of us/ds samples with low reporting limits. Nitrate and sulfate increased in the Aqueduct on two sample dates and decreased on one. Discrepancies with the nitrate database possibly marginalized the observed trends. Decreases were recorded for chloride and DOC on two of three sample dates while slight to no changes were observed for conductivity, bromide, and arsenic. None of the COCs exceeded existing drinking water MCLs in the Aqueduct.

San Luis Field Division

A small volume of water (111 af) was admitted to the Aqueduct at Mile Post (MP) 79.67 from a nearby well within the San Luis Water District. Daily inflows ranged from 2.8 to 4.0 cfs during August 22 to September 7 and composed between 0.01 and 0.07% of daily Aqueduct flows. The turn-in agreement acceptance standards for conductivity, chloride, and sodium were exceeded and pumping was discontinued. Although us/ds monitoring for COCs in the Aqueduct detected measurable changes in water quality, the changes were thought to be largely attributable to factors unrelated to the inflows due to the low dilution factors.

Inflows to the Aqueduct from Westlands Water District at Lateral 7L (MP 115.43) were begun on December 21 and continued into 2013. The non-Project water originated from Kings River floodwaters routed through the Mendota Pool and pumped into Aqueduct. Daily flows ranged from 45 to 76 cfs with a total volume of 1,166 af for the month. Turn-ins composed at least 2.1 to 16.6% of daily Aqueduct flows with an overall dilution factor of at least 8.4% for the December inflow period. Water quality monitoring in the Aqueduct registered declines in nitrate, bromide, and DOC and increases in chloride, salinity, and sulfate. No changes were observed for arsenic and total chromium.

II. Introduction

Non-Project water can be admitted to the Edmond G. Brown California Aqueduct (Aqueduct) for conveyance and redistribution. Non-Project water is considered to be any input to the State Water Project (SWP) for conveyance by the SWP that is not directly diverted from the Sacramento-San Joaquin Delta (Delta). Aqueduct channel capacity is used to move candidate waters from a point of availability to a point of need. Participants of an approved program include both SWP and non-SWP contractors that bank groundwater and routinely convey it into the Aqueduct at various locations. Although most non-Project inflows originate as groundwater, particularly from Kern County, other waters admitted to the Aqueduct include excess surface flows or floodwaters typically from southern Sierra Nevada watersheds. Examples of these waters include floodwaters from the Kings River redirected through the Mendota Pool (this year and others) and dewatering of Lake Isabella in the Kern River watershed to prevent a catastrophic dam breach that could result from defects discovered in 2006. Non-Project waters enter the Aqueduct at turn-in sites, structures for water conveyance into the Aqueduct, which can often be used as turn-outs for water deliveries from the Aqueduct. As such, non-Project inflows have been generally termed as turn-ins to encompass both groundwater pumped directly into the Aqueduct from local wells (pump-ins) and other groundwater or surface water conveyed into the Aqueduct via turn-in sites. Turn-in water may be used for local redistribution or transfer to other water entities.

Turn-ins to the Aqueduct must meet certain requirements. The proponent of any turn-in proposal shall demonstrate that the water is of consistent, predictable, and acceptable quality. In accordance with the California Water Code, water may be conveyed or transferred via any unused capacity of the Aqueduct provided that the comingled water does not result in a diminution of water quality. The transfer must be made without unreasonably affecting fish, wildlife, or other instream beneficial uses. The California Department of Water Resources (DWR) established interim procedures and criteria in 2001, with an update in 2012, to review the water quality of proposed turn-ins and determine their approval process for acceptance into the Aqueduct using a two-tiered approach (Appendix A). Tier 1 programs have criteria with “no adverse impacts” based on historical water quality in the Aqueduct. Programs meeting Tier 1 criteria are generally approved by DWR without referral to the SWP contractor facilitation group for review. Tier 2 programs are implemented when turn-in water quality is generally lower than historic Aqueduct conditions and have the potential to negatively influence water quality. Tier 2 programs are referred to the SWP contractor facilitation group for review and response to DWR. DWR staff considers all factors before making a decision on any turn-in request. Prospective turn-in entities are required to submit proposals describing their expected turn-ins including detailed water quality analyses, source water descriptions, identification of wells, inflow rates, duration, etc.

III. San Joaquin Field Division

Turn-ins in the San Joaquin Field Division during 2012 were active during two distinct periods; March-June and December. The largest turn-in volumes were admitted to the Aqueduct from March through June, and are discussed first followed by the December inflows.

From March through June, groundwater was admitted to the Aqueduct at six turn-in locations over a 43-mile stretch between Mile Posts (MPs) 238 and 281. Participating or coordinating water entities and their turn-in locations are listed below and depicted in Figure 1.

AEWSD	Arvin-Edison Water Storage District (MP 277.30)
KCWA and KWBA	Kern County Water Agency and Kern Water Bank Authority via the Cross Valley Canal (CVC) at MP 238.04 and/or Kern Water Bank Canal (KWBC) at MP 238.19
WRMWSD	Wheeler Ridge-Maricopa Water Storage District (four turn-in locations between MPs 270.24 and 280.14)

Turn-in Volumes

Turn-in volumes totaled 119,335 acre-feet (af) over the four-month period of activity with monthly totals ranging from 18,854 af in June to 39,296 af in April (Table 1 and Figure 2). KWBC contributed the largest volume with 79.6% of the total, followed by CVC with 10.9%, AEWSD with 7.5%, and WRMWSD with 1.1% (combined from four individual sources). Monthly turn-ins were consistently greatest from KWBC, ranging between 18,396 af (June) and 29,607 af (April). Turn-ins from CVC and AEWSD were both highest in March with volumes of 7,085 and 6,495 af, respectively. Monthly turn-ins from all WRMWSD wells combined ranged from a high of 481 af in April to a low of 373 af in May.

Most of the turn-ins were admitted to the Aqueduct at MP 238.04 (CVC) and MP 238.19 (KWBC), just upstream from Check 29 at MP 244.54. Total monthly inflow volumes from these two sources relative to Aqueduct flow-volumes (percent-of-Aqueduct or dilution factors in percentage) pumped at Buena Vista Pumping Plant ranged from 9.3% in June to 39.8% in March with a total of 17.1% altogether for the four-month period (Table 1). Deliveries between the turn-ins and the pumping plant were incorporated in the calculations for more accurate dilution factor estimates.

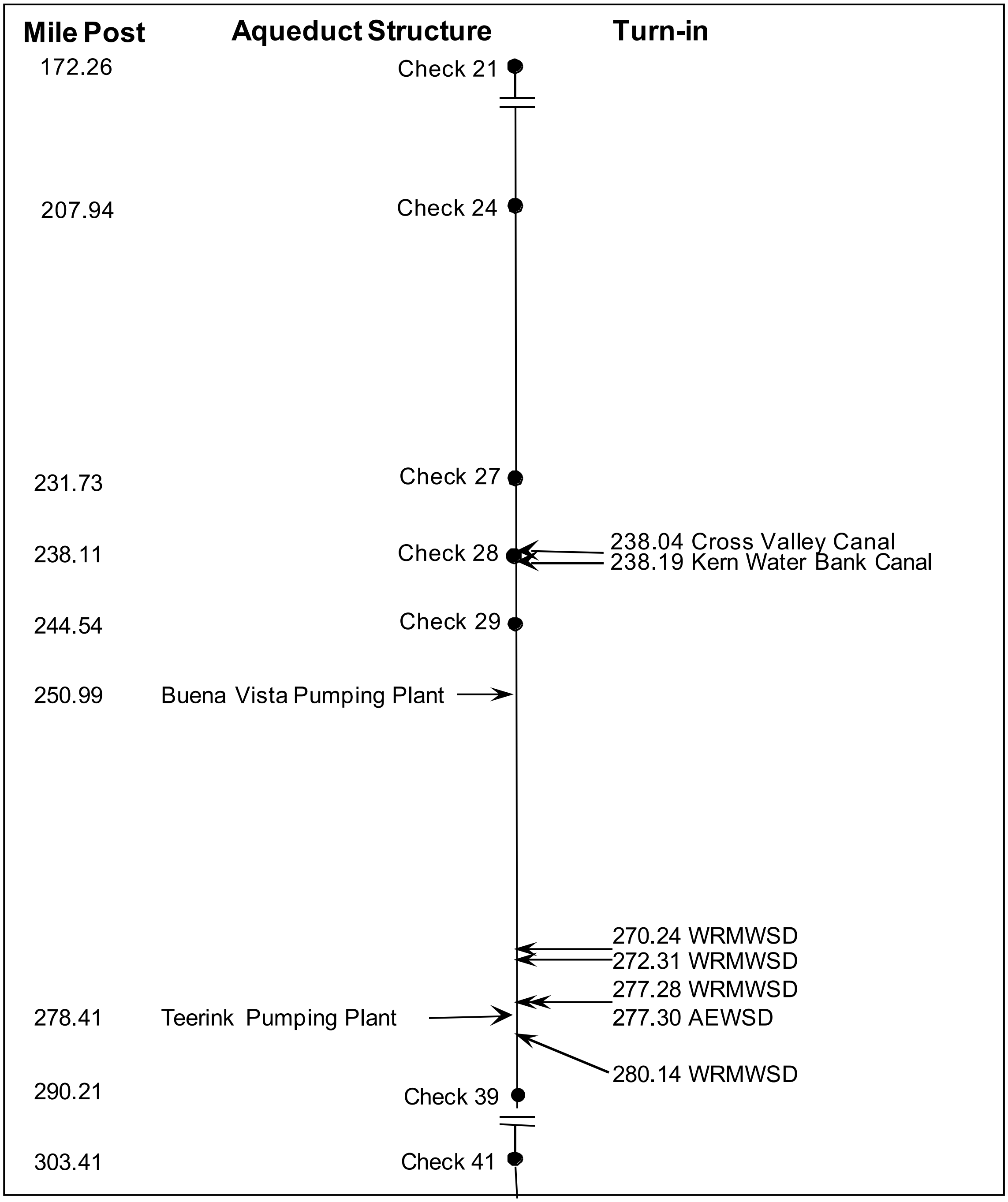

Figure 1. Schematic of California Aqueduct Features and Turn-in Locations

Farther downstream, turn-ins from AEWSD were admitted to the Aqueduct at MP 277.3 and those from WRMWSD were admitted at four locations between MPs 270.24 and 280.14, all upstream from Check 39. Inflows from AEWSD and/or WRMWSD composed from 0.22% (May) to 7.5% (March) of the total Aqueduct flow-volume passing Teerink Pumping Plant. During the month of highest inflow (6,495 af in March), all of the turn-in water originated from AEWSD,

Table 1. Turn-in Volumes, California Aqueduct Flow-volumes, and Percentage of Aqueduct Flow-Volume (values in acre-feet [af] unless specified)

Month	KWBC	CVC	Deliveries a/	Buena Vista PP	% of Aqueduct Flowb/	WRMWSD	AEWSD	Deliveries a/	Teerink PP	% of Aqueduct Flowb/	Total Turn-in	% of Aqueduct Flow
March	25,130	7,085	545	80,411	39.8%		6,495	2,633	84,078	7.5%	38,710	47.3%
April	29,607	5,783	606	134,656	26.2%	481	3,425	2,532	136,404	2.8%	39,296	29.0%
May	21,909	103	1,491	217,721	10.0%	373	90	6,791	203,159	0.22%	22,475	10.3%
June	18,396		20,669	177,302	9.3%	458		8,867	151,522	0.29%	18,854	9.6%
af Total	**95,042**	**12,971**	**23,311**	**610,090**	**17.1%**	**1,312**	**10,010**		**575,163**	**1.97%**	**119,335**	**19.0%**
% of Total Turn-in	79.6%	10.9%				1.1%	8.4%					

KWBC=Kern Water Bank Canal, CVC=Cross Valley Canal, WRMWSD=Wheeler Ridge-Maricopa Water Storage District
AEWSD=Arvin-Edison Water Storage District, PP=Pumping Plant

a/ Deliveries at turn-outs between turn-ins and the pumping plants. Turn-outs between the upstream-most WRMWSD turn-in site and Teerink Pumping Plant were interspersed between the other turn-ins, so the percentage of Aqueduct flow values may not be exact.

b/ Turn-ins divided by pumping + deliveries

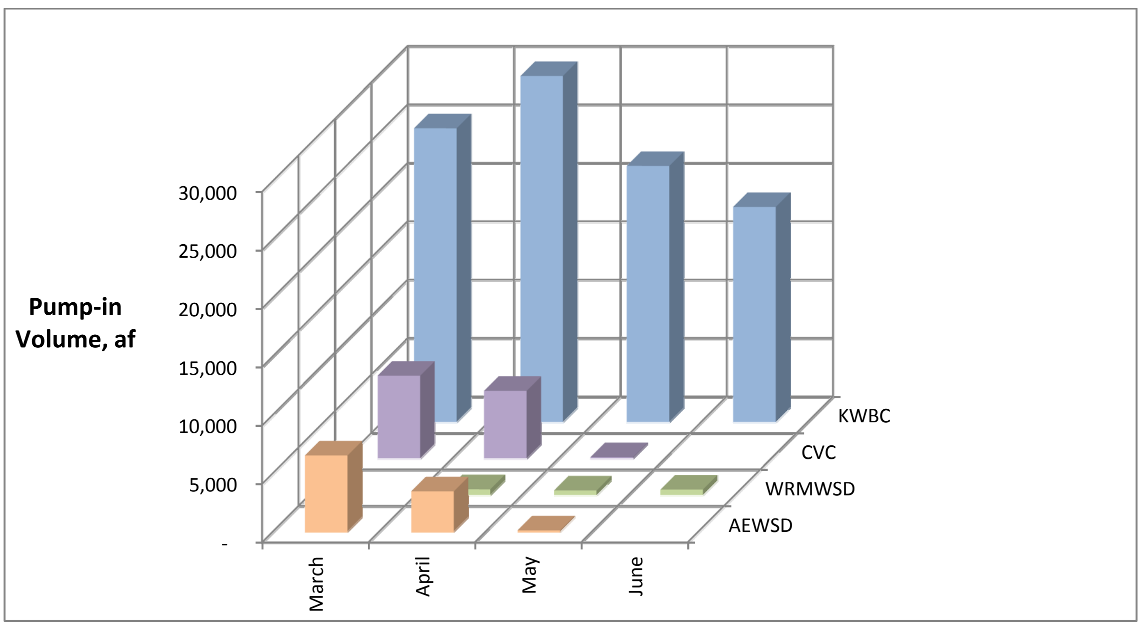

Figure 2. Monthly Turn-in Volumes

accounting for 7.5% of the Aqueduct flow-volume. The four-month dilution factor from post-Check 29 sources of 1.97% was much smaller than the pre-Check 29 value of 17.1%. The dilution factor for all turn-ins during the four-month period was 19.0%.

Turn-in Water Quality

Turn-ins to the Aqueduct were monitored by DWR and the participating entities for a variety of water quality parameters. Although the analyses sometimes included a comprehensive suite of parameters, the focus was on seven parameters that were considered to be of greatest importance from a drinking water standpoint, called constituents-of-concern (COCs). COCs included arsenic, bromide, conductivity, dissolved and/or total organic carbon (DOC/TOC), nitrate (as NO_3), sulfate, and total dissolved solids (TDS). Total chromium (trivalent + hexavalent) and hexavalent chromium were also periodically analyzed.

DWR sampled inflows from AEWSD, KWBC, and CVC for a full suite of parameters including major minerals, physical parameters (pH, turbidity, etc.), metals, DOC/TOC, and nutrients. KCWA sampled inflows from KWBC and CVC for COCs. Similar analyses were reported by AEWSD for their inflows. Turn-in water was monitored where it entered the Aqueduct except from WRMWSD sources. WRMWSD provided California Department of Public Health (DPH) Title 22 water quality data from individual wellhead sampling. Three of the four WRMWSD turn-in discharges to the Aqueduct contained a groundwater blend from two or more wells. Blending calculations by WRMWSD were continually reviewed to verify that the final blend entering the Aqueduct complied with Title 22 drinking water standards.

COCs in turn-ins or wells and any associated drinking water standards are presented in Table 2. The full complement of analyses is listed in Appendices B through D. All water quality data originated from sampling during 2012.

Arsenic

Arsenic ranged between 0.0019 and 0.004 milligrams per liter (mg/L) in turn-ins from AEWSD, KWBC, and CVC. WRMWSD wells exhibited a wider span of arsenic concentrations; 8 wells at <0.002 mg/L, nine between 0.0023 and 0.013 mg/L, two wells sampled twice with one positive detection (0.0021 to 0.0025 mg/L) and one negative detection each, and one at 0.033 mg/L (MOC #B4). The MOC #B4 well concentration of 0.033 mg/L exceeded the primary maximum contaminant level (MCL) of 0.010 mg/L for arsenic in treated drinking water. Note that this well was one of several where pumpage was blended together prior to entering the Aqueduct. As stated earlier, WRMWSD staff continually reviewed calculations to verify that the actual input blend complied with Title 22 water quality standards.

Bromide

Bromide ranged between 0.08 and 0.21 mg/L for AEWSD, KWBC, and CVC. Bromide in WRMWSD wells ranged from 0.07 to 1.2 mg/L. No drinking water standard exists for bromide.

Table 2. Constituents-of-Concern in Turn-ins or Wellheads and any Associated Drinking Water Standards (values in milligrams per liter [mg/L] unless specified)

Drinking Water Standards*					Arsenic	Bromide	Conductivity (µS/cm)	Chromium	Hexavalent Chromium (µg/L)	Nitrate	Sulfate	DOC a/	TOC b/	TDS c/
Primary Maximum Contaminant Level					0.01			0.05		45				
Secondary Maximum Contaminant Level														
Recommended							900				250			500
Upper							1,600				500			1,000
Short Term							2,200				600			1,500
Public Health Goal **									0.02					
Inflow Source	**Milepost**	**Participating Entities/ Well Name/Owner**	**Data Source**	**Date**										
AEWSD	277.30	AEWSD	DWR	3/5/2012	0.003	0.08	290	0.002	NA	5.4	16	0.9	1	165
			AEWSD	3/7/2012	0.004	0.08	NA	0.002	2.29	6.4	18	NA	<0.3	180
CVC	238.04	KCWA, KWBA, Others	DWR	3/5/2012	0.003	0.16	415	0.001	NA	7.7	37	0.9	1	246
			KCWA	3/8/2012	0.0037	0.19	NA	NA	0.89	7.9	35	NA	0.64	230
KWBC	238.19	KCWA, KWBA, Others	DWR	3/5/2012	0.002	0.20	492	0.001	NA	8.6	52	1	1	297
			KCWA	3/8/2012	0.0019	0.19	NA	NA	0.86	8.3	46	NA	0.59	270
			DWR	6/4/2012	0.003	0.21	448	0.001	NA	7	56	<0.5	<0.5	268
WRMWSD	270.24	WRM-7 Well	WRMWSD	4/10/2012	0.0046	0.28	1,100	<0.01	<0.2	41	370	<0.2	NA	770
		Sun Pacific #6	WRMWSD	4/10/2012	0.0086	0.082	650	<0.01	<0.2	<2	180	<0.2	NA	430
		Sun Pacific #7	WRMWSD	4/25/2012	0.0062	0.22	1,100	<0.01	<0.2	<3	340	<0.2	NA	680
		Sun Pacific #8	WRMWSD	5/7/2012	0.0073	0.25	1,200	<0.01	0.35	<3	410	<0.2	NA	840
		WRM 7P-P2	WRMWSD	3/8/2012	0.0021	0.19	1,100	<0.01	<0.2	2.7	390	0.49	NA	740
	272.31	Maricopa Orchards	WRMWSD	4/10/2012	0.0065	0.13		<0.01	<0.2	7.3	410	0.26	NA	750
	277.28	Fry #2	WRMWSD	5/17/2012	<0.002	0.17	1,100	<0.01	<0.2	7.8	380	0.22	NA	780
		Fry #3	WRMWSD	5/14/2012	0.0023	0.23	1,450	<0.01	<0.2	14	570	0.33	NA	1,100
	280.14	WRM #A4	WRMWSD	3/2/2012	0.0021	0.62		<0.01	0.26	110	420	<0.2	NA	1,100
			WRMWSD	3/7/2012	<0.002	0.65	1,600	<0.01	0.25	130	450	<0.20	NA	1,200
		WRM #A3	WRMWSD	3/2/2012	0.0025	0.35		<0.01	0.37	77	320	<.20	NA	820
			WRMWSD	3/7/2012	<0.002	0.32	1,200	<0.01	0.4	78	340	<.20	NA	870
		WRM #A2	WRMWSD	3/2/2012	<0.002	0.21		<0.01	<0.2	32	410	<0.2	NA	880
			WRMWSD	3/7/2012	<0.002	0.19	1,200	<0.01	<0.2	36	370	<0.2	NA	920
		WRM #A1	WRMWSD	3/2/2012	<0.002	0.4		<0.01	2.2	110	470	<0.5	NA	1,100
			WRMWSD	3/7/2012	<0.002	0.33	1,500	<0.01	0.5	110	470	<0.2	NA	1,100
		MOC #B4 aka MOC 3012	WRMWSD	4/11/2012	0.033	0.13	500	<0.01	<0.1	<1	24	<0.2	NA	280
		MOC #B5	WRMWSD	4/12/2012	<0.002	0.08	490	<0.01	1.2	1.5	43	<0.2	NA	290
		WRM #PB-1	WRMWSD	3/2/2012	0.0086	0.08		<0.01	<0.2	<1	27	<.20	NA	240
			WRMWSD	3/14/2012	0.013	0.07	460	<0.01	<0.2	<1	29	<0.2	NA	280
		WRM #B2	WRMWSD	3/7/2012	0.013	0.1	550	<0.01	<0.20	<1	47	0.21	NA	340
		WRM #B1	WRMWSD	3/20/2012	<0.002	0.21	820	<0.01	0.64	19	150	0.64	NA	500
		Tejon Ranch #A7	WRMWSD	4/17/2012	<0.002	1.2	1,700	<0.01	0.65	19	410	0.45	NA	1,100
		WRM #PA-1	WRMWSD	4/9/2012	<0.002	0.17	1,200	<0.01	<0.2	6.6	390	<0.2	NA	850
		Hein Ranch	WRMWSD	5/8/2012	<0.002	0.18	1,300	<0.01	<0.2	110	740	<0.2	NA	1,300

a/ DOC=dissolved organic carbon; b/ TOC=total organic carbon; c/ TDS=total dissolved solids
* Cal. Admin. Code tit. 22, § 64431 to 64449.4; **OEHHA, 2007

Conductivity

AEWSD exhibited the lowest conductivity with 290 micro Siemens per centimeter (µS/cm) while values for KWBC and CVC ranged higher, from 415 to 492 µS/cm. Conductivity in WRMWSD wells ranged from 460 to 1,700 µS/cm; 13 above the recommended secondary MCL of 900 µS/cm and one above the upper secondary MCL of 1,600 µS/cm. Conductivity data was not reported for one WRMWSD well.

Chromium

Total chromium (trivalent plus hexavalent) ranged from 0.001 to 0.002 mg/L for CVC, KWBC, and AEWSD and was below the reporting limit (<0.01 mg/L) in all WRMWSD wells — less than the primary MCL of 0.05 mg/L for total chromium in drinking water. Hexavalent chromium was 0.89 and 0.86 micrograms per liter (μg/L) for CVC and KWBC, respectively. The highest concentration of 2.29 μg/L was detected in one sample from AEWSD. Hexavalent chromium in WRMWSD wells ranged from below the reporting limits of <0.1 and <0.2 (14 wells) to 2.20 μg/L in WRM #A1. Note that the WRM #A1 well was sampled five days later and the concentration had declined to 0.5 μg/L. All positive detections exceeded the Public Health Goal (PHG) of 0.02 μg/L for hexavalent chromium in drinking water. The PHG is a level of drinking water contaminant at which adverse health effects are not expected to occur from a lifetime of exposure (OEHHA, 2007).

Dissolved and Total Organic Carbon

Concentrations ranged between <0.2 and 1 mg/L in all turn-ins and wells. No drinking water standards exist for these constituents.

Nitrate

Nitrate ranged between 5.4 and 8.6 mg/L for AEWSD, CVC, and KWBC. Six WRMWSD wells contained nitrate below the report limits of between <1 and <3 mg/L while the others ranged from 1.5 mg/L to 130 mg/L (WRM #A4). Four wells exhibited nitrate concentrations above the primary MCL of 45 mg/L for nitrate in drinking water. Note that pumpage from these wells was blended together with several others prior to entering the Aqueduct.

Sulfate

Sulfate was lowest in two samples from AEWSD at 16 and 18 mg/L and ranged from 35 to 56 mg/L for CVC and KWBC. WRMWSD wells displayed two general ranges: concentrations were 24 to 160 mg/L in six wells, while in the others, sulfate ranged from 320 to 740 mg/L. Fourteen WRMWSD wells were above the recommended secondary MCL of 250 mg/L for sulfate in drinking water, two were above the upper secondary MCL (500 mg/L), and one was above the short term secondary MCL (600 mg/L).

Total Dissolved Solids

Similar to several of the other salinity-related parameters, AEWSD exhibited the lowest TDS concentrations of 165 and 180 mg/L while levels for KWBC and CVC ranged higher from 230 to 297 mg/L. TDS in six WRMWSD wells ranged from 280 to 500 mg/L, while it ranged from 680 to 1,300 mg/L in the others. All but six wells contained TDS above the recommended secondary MCL of 500 mg/L and five wells exceeded the upper secondary MCL of 1,000 mg/L.

California Aqueduct Water Quality

An upstream/downstream (us/ds) assessment of water quality was performed for two separate segments of the Aqueduct. Sampling data from Checks 27 and 29 were used to assess any water quality changes resulting from CVC + KWBC inflows. Checks 27 and 29 at MPs 231.73 and 244.54, respectively, are 12.81 miles apart and bracket both turn-in locations which are situated at about MP 238. Data from Check 21 (MP 172.26) was also included in the assessment to reveal any trending water quality variations moving down the Aqueduct from influencing operations or conditions farther upstream (San Luis Reservoir releases, south Sacramento-San Joaquin Delta exports at Banks Pumping Plant, and pumpage from the Delta-Mendota Canal via O'Neill Pumping-Generating Plant and the Intertie).

Farther downstream, potential changes in water quality owing to inputs from AEWSD and WRMWSD were assessed between Checks 29 and 39 (MP 290.21). The distance between these stations is 45.67 miles. Data from Check 41 (MP 303.41) were also included in the assessment to round out the downstream database, capturing short duration changes that may not have been detected at Check 39. Further, this station provided the only downstream data for June.

Two types of graphs were used to present the data. One pair of graphs shows all data for each parameter at both segments of Aqueduct along with monthly dilution factors. The dilution factors represent monthly totals — Aqueduct and turn-in flow-volumes — and thus actual values on any particular date will be unique to specific daily flow conditions. Four other graphs per sampling run were presented showing to-scale transects of the Aqueduct during the turn-in period using data from all five stations (when available). These later graphs provide a water quality "snapshot" showing the progression of any concentration changes throughout the stretch of Aqueduct encompassing all water quality stations on a particular sampling run. Sampling runs between stations sometimes varied by up to two days apart.

Two month "shoulders" on either side of the turn-in period were included to illustrate any concentration fluctuations between stations resulting from the transport of segments of changing water quality that pass multiple sampling stations at different times. These effects can influence the outcome of any us/ds analysis depending on the distance between stations — the greater the distance, the higher degree of influence. As such, the water quality changes between Checks 27 and 29 (12.81 miles apart) would be less affected compared with the same analysis between Checks 29 and 39 (45.67 miles apart) owing to the shorter intervening distance. Other factors potentially influencing the us/ds analysis included daily variations in discharge flow/quality, Aqueduct flow/quality, and any inherent variability associated with the relative precision of analytical methods. Because of these influencing factors, calculated concentration differences between us/ds stations cannot always be considered, by varying degrees, exclusively attributable to the inputs.

Arsenic

Figure 3A shows arsenic in the Aqueduct at Checks 21, 27, and 29 along with monthly dilution factors from CVC and KWBC combined. During the turn-in period, arsenic was higher at Check

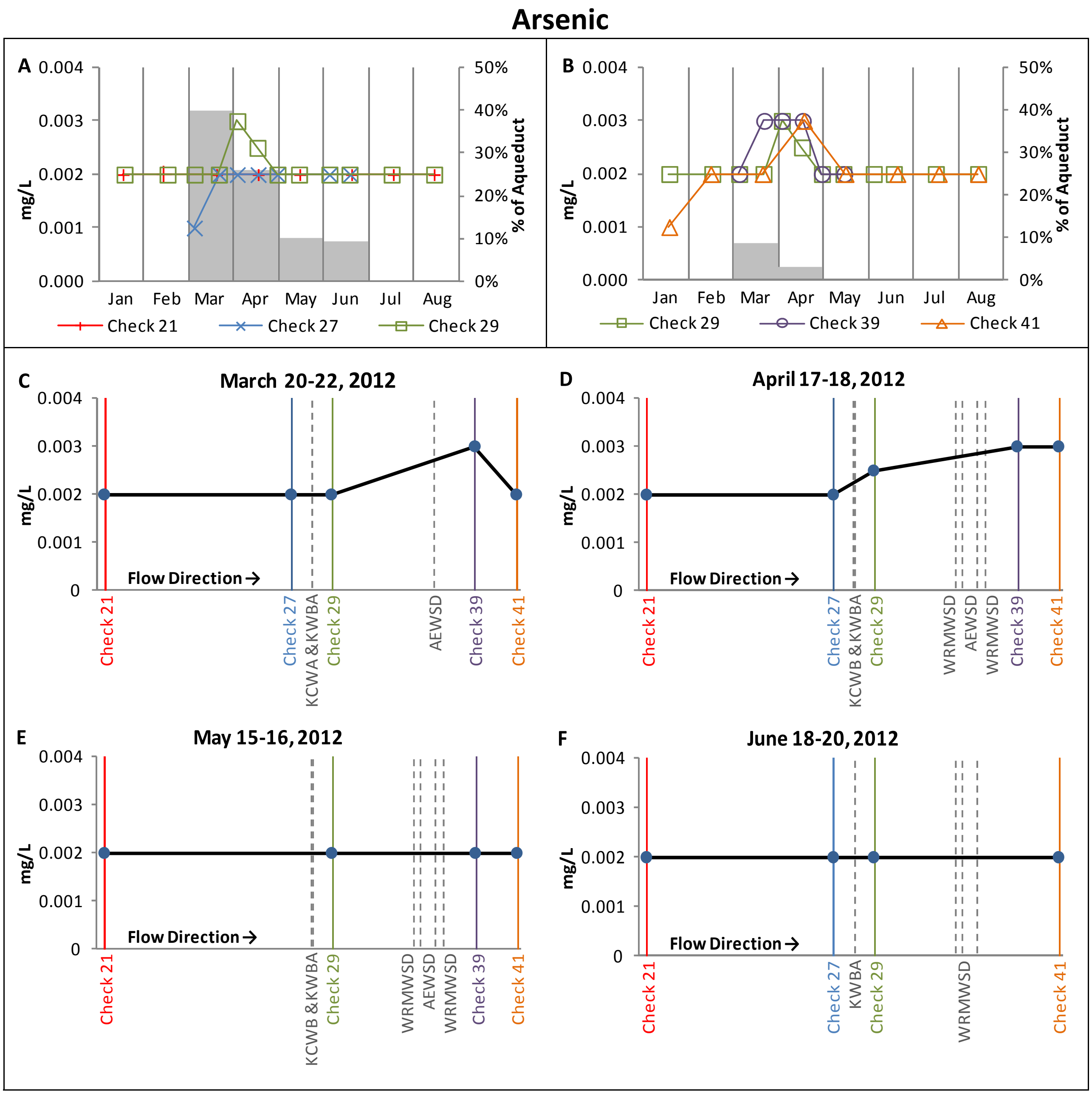

Figure 3. Upstream/Downstream Arsenic Concentrations in the California Aqueduct

29 than Check 27 on three sampling dates, while on the other four dates, there was no difference (Figures 3A, C-D, F, and Table 3). The increases ranged from 0.0005 to 0.001 mg/L (25 to 100%). The increase of 0.0005 mg/L was less than the reporting limit of <0.001 mg/L due to duplicate samples collected from Check 29 on April 17 which exhibited values of 0.002 and 0.003 mg/L; the average was used in the analysis (see Appendix E for COC sample data in the Aqueduct). The duplicate results can reflect variations inherent in the analytical methodology, possibly indicating that the “true” concentration may be somewhere in-between. Duplicate samples were also collected from Check 29 on May 15 and June 18 and all exhibited an arsenic concentration of 0.002 mg/L.

Arsenic increases between Checks 27 and 29 occurred during months when turn-ins composed from 26.2 to 39.8% of the Aqueduct (April and March, respectively), although during the same months, no us/ds differences were reported on two sampling dates. During June when turn-ins composed 10.0% of the Aqueduct, no change in arsenic between stations was documented on two sampling dates. These trends were not unexpected considering that the arsenic range at Check 27 (0.001-0.002 mg/L, averaging 0.0019 mg/L) overlapped the lower end of the turn-in range (0.0019-0.0037 mg/L, averaging 0.0027 mg/L). With the exception of the early March sample at Check 27, arsenic remained at 0.002 mg/L before, during, and after the turn-in period at Checks 21 and 27, revealing that downstream migrating segments of water with higher or lower arsenic levels were limited. As such, the us/ds increases in arsenic that were revealed on three of seven sampling dates can be more assuredly attributed to the turn-ins than if upstream concentrations had exhibited higher variability.

Table 3. Constituents-of-Concern Changes in the California Aqueduct Upstream/Downstream from the Turn-ins between Checks 27 and 29

	Concentration Range		Increases				Decreases				No Change
Analyte	C27 (Upstream)	C29 (Downstream)	# of Samples	Range	% Change a/	Average	# of Samples	Range	% Change	Average	# of Samples
Arsenic	0.001 to 0.002	0.002 to 0.003	3	0.0005 to 0.001	(25 to 100)	0.00083	0				4
Bromide	0.20 to 0.26	0.17 to 0.24	0				3	-0.01 to -0.04	(-4.2 to -19)	-0.02	4
Conductivity	428 to 633	417 to 561	2	2 to 9	(0.5 to 2)	6	4	-15 to -73	(-3 to -11)	-42	1
Dissolved Organic Carbon	2.5 to 5.7	2.1 to 4.6	0				7	-0.2 to -1.1	(-5.3 to -21)	-0.7	0
Nitrate	1.6 to 5.0	2.4 to 5.2	7	0.2 to 1.6	(3 to 100)	0.9	0				0
Sulfate	35 to 68	36 to 60	4	1 to 3	(3 to 8)	3	3	-1 to -8	(-2 to -12)	-4	0
Total Dissolved Solids	240 to 356	230 to 319	2	1 to 7	(1 to 3)	4	5	-5 to -37	(-2 to -21)	-18	0

a/ The percent change is a relative parameter and should not be considered exclusive of absolute changes as compared to MCLs or other important standards

Farther downstream, arsenic increased by 0.0005 and 0.001 mg/L (20 to 50%) between Checks 29 and 39 on two sampling dates while concentrations were unchanged on four dates (Figures 3B-E and Table 4). The increases were recorded during March and April when turn-ins composed 7.5 and 2.8% of the Aqueduct, respectively. On April 17, when arsenic increased from 0.0025 mg/L at Check 29 (duplicate sample average of 0.002 and 0.003 mg/L) to 0.003 mg/L at Check 39, the higher arsenic concentration was also detected at Check 41 the following day, on April 18 (Figure 3D). The increase at both downstream stations suggests a sustained influence from the intervening turn-ins. Conversely, on another occasion (March 21-22), arsenic increased by 0.001 mg/L to 0.003 mg/L at Check 39, but Check 41 did not exhibit the higher concentration (Figure 3C). In this case, the increase was not sustained or concentrations between downstream stations were influenced by other factors such as changes in dilution factors between sampling dates or methodology precision. The dilution factors were lower in May and June (0.22 to 0.29%) and no differences in arsenic were detected between Checks 29 and 39 or 41. All us/ds analyses were below the primary MCL of 0.010 mg/L for arsenic in drinking water.

Bromide

Bromide concentrations were lower at Check 29 than Check 27 on three sampling dates by 0.01 to 0.04 mg/L (-4 to -19%) while no change in concentration was reported on the other four dates (Figures 4A, C-D, F, and Table 3). These trends can be explained by a turn-in concentration

Table 4. Constituents-of-Concern Changes in the California Aqueduct Upstream/Downstream from the Turn-ins between Checks 29 and 39

	Concentration Range a/		Increases				Decreases				No Change
Analyte	C29 (Upstream)	C39 (Downstream)	# of Samples	Range	% Change b/	Average	# of Samples	Range	% Change	Average	# of Samples
Arsenic	0.002 to 0.003	0.002 to 0.003	2	0.0005 to 0.001	(20 to 50)	0.00075	0				4
Bromide	0.20 to 0.24	0.18 to 0.24	1	0.03	(15)		3	-0.01 to -0.05	(-4.4 to -21)	-0.03	2
Conductivity	435 to 560	438 to 589	4	9 to 35	(2 to 7)	21	2	-6.5 to -61	(-1.4 to -12)	-34	0
Dissolved Organic Carbon	2.7 to 4.6	1.8 to 4.4	1	0.3	(8.6)		5	-0.15 to -1.1	(-3.3 to -33)	-0.5	0
Nitrate	2.5 to 5.2	2.4 to 5.8	4	0.4 to 0.9	(12.5 to 25)	0.7	2	-0.1 to -1.4	(-4 to -35)	-0.7	0
Sulfate	39 to 60	37 to 66	2	6	(10 to 11)	6	3	-1.5 to -5	(-4 to -11)	-3	1
Total Dissolved Solids	242 to 319	245 to 338	4	3 to 19	(1 to 6)	10	2	-6 to -28	(-2 to -10)	-17	0

a/ Note that Check 29 ranges may differ from those in Table 3 due to different comparison dates; b/ The percent change is a relative parameter and should not be considered exclusive of absolute changes as compared to MCLs or other important standards

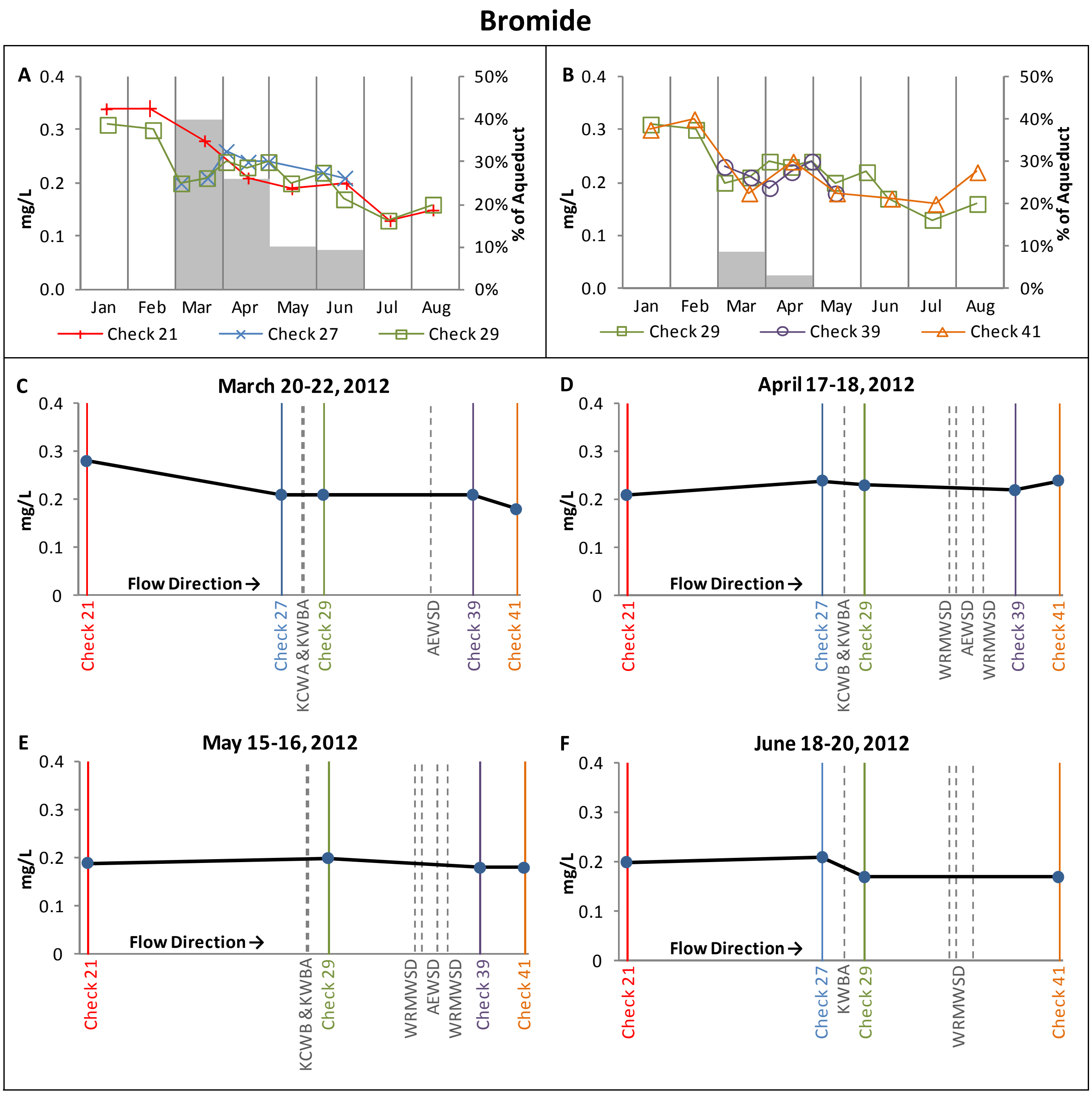

Figure 4. Upstream/Downstream Bromide Concentrations in the California Aqueduct

range (0.16 to 0.21 mg/L) that was slightly lower than in the Aqueduct (0.2 to 0.26 mg/L). Therefore, no change or decreases averaging 0.02 mg/L in Aqueduct bromide concentrations were recorded in the us/ds analysis of CVC and KWBC turn-ins during the period of activity.

Figures 4A and C show dissimilar concentrations between Checks 21 and 27 in the mid March samples: bromide at Check 21 trended higher than at Check 27. Although it appears that an intervening discharge source might have diluted bromide, daily conductivity from automated water-quality monitoring stations showed a downstream migrating salinity trough was the principal cause of the disparity. The conductivity trough was flanked between the sampling dates of mid February and mid March at Check 21 (Figure 5). The trough had passed Check 21 by the mid March sampling date but was continuing past Checks 27 and 29 during the same sampling run (note that samples at Checks 21 and 27 were collected two days apart in mid March, Appendix E). Using data from the more distant Check 21 would have led to erroneous conclusions regarding bromide changes resulting from turn-ins. (Check 21 is more than 59 miles upstream from Check 27 and 72 miles upstream from Check 29.) This trend was also apparent for the other salinity-related parameters discussed below, highlighting the importance of choosing nearby stations for us/ds water quality comparisons. Stations closely bracketing the input sources are preferred in order to reduce the effects of downstream-migrating segments of changing water quality and transport times on data from multiple discrete sampling sites.

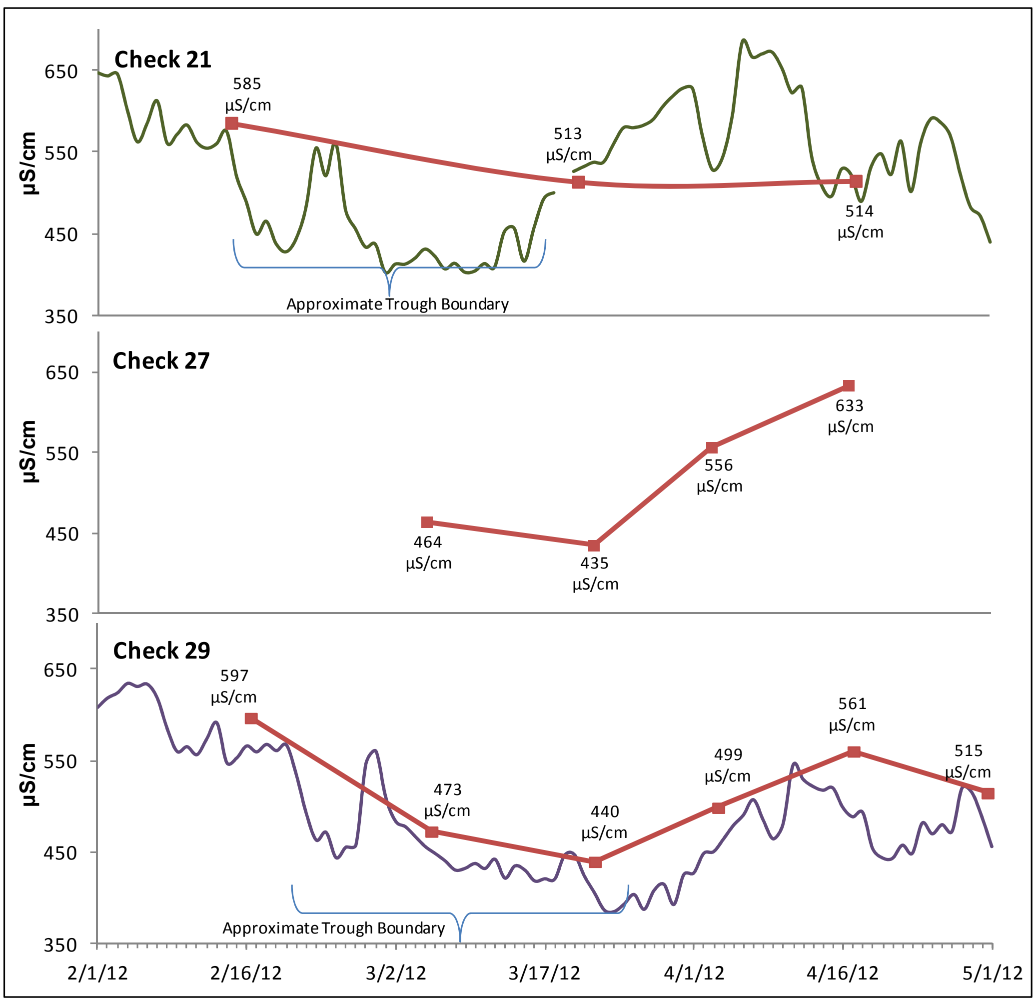

Figure 5. Conductivity Trough Moving down the California Aqueduct at Checks 21, 27, and 29

Farther downstream, bromide between Checks 29 and 39 declined by 0.01 to 0.05 mg/L (-4 to -21%) on three sample dates, increased by 0.03 mg/L (15%) on one date, and was unchanged on two others (Figures 4B-E and Table 4). The greatest decline in bromide between stations was 0.05 mg/L from samples collected during the first week of April. The decline appears to be attributable to AEWSD owing to a relatively low bromide concentration of 0.08 mg/L in the turn-in compared with Aqueduct levels of from 0.2 to 0.24 mg/L at Check 29. Moreover, influence from AEWSD on that date was supported by co-occurring us/ds trends for several other COCs including reductions in conductivity, DOC, and sulfate, as well as an increase in nitrate. These changes (increase or decrease) were compatible with relative concentrations between AEWSD and Aqueduct waters. Trends of similar magnitude associated with AEWSD were not observed for the other April sampling dates and may be attributable, in part, to potential variations in turn-in and/or Aqueduct flows on a daily basis or countering influence from WRMWSD.

Conductivity

Turn-ins from KWBC and CVC provided a net benefit to Aqueduct salinity during April when upstream levels were highest, with minor or no effect during rest of the turn-in period when conductivity between waters was more similar. Conductivity was lower at Check 29 than Check 27 on four sampling dates by 15 to 73 micro Siemens per centimeter (μS/cm) (-3 to -11%, Figures 6A, D, F, and Table 3). Most of the decreases were measured in April when the dilution factor averaged 26.2% for the month. On three sampling dates, conductivity at Check 29 was either nominally higher (by ≤2%) or the same as Check 27. The declines during April can be attributed to Check 27 levels of 539 to 633 μS/cm during that month which were higher than turn-in levels (415 to 492 μS/cm). Conductivity at Check 27 outside of April was lower and overlapped the turn-in range.

Conductivity at Check 21 was higher than at Check 27 in the mid March sample (513 μS/cm versus 435 μS/cm, Figures 6A, C). The apparent decrease can instead be attributed to a downstream-migrating conductivity trough that had passed Check 21 prior to that sampling date, but was positioned around Checks 27 and Check 29 on the same mid March sampling run (see more detailed discussion for bromide above and Figure 5). Another example of a downstream flowing segment of changing water quality was revealed in mid April when conductivity at Check 21 (514 μS/cm) was 119 μS/cm lower than at Check 27 (633 μS/cm, Figure 6A, D). Figure 5 shows that a slug of elevated conductivity was bracketed between the mid March and mid April sample dates at Check 21, but was apparently present at Check 27 on the mid April sampling run. Without accounting for these concentration ridges or troughs, any us/ds analysis in the Aqueduct using data from far-field stations might erroneously assign responsibility for constituent increases or decreases between stations to the input of interest.

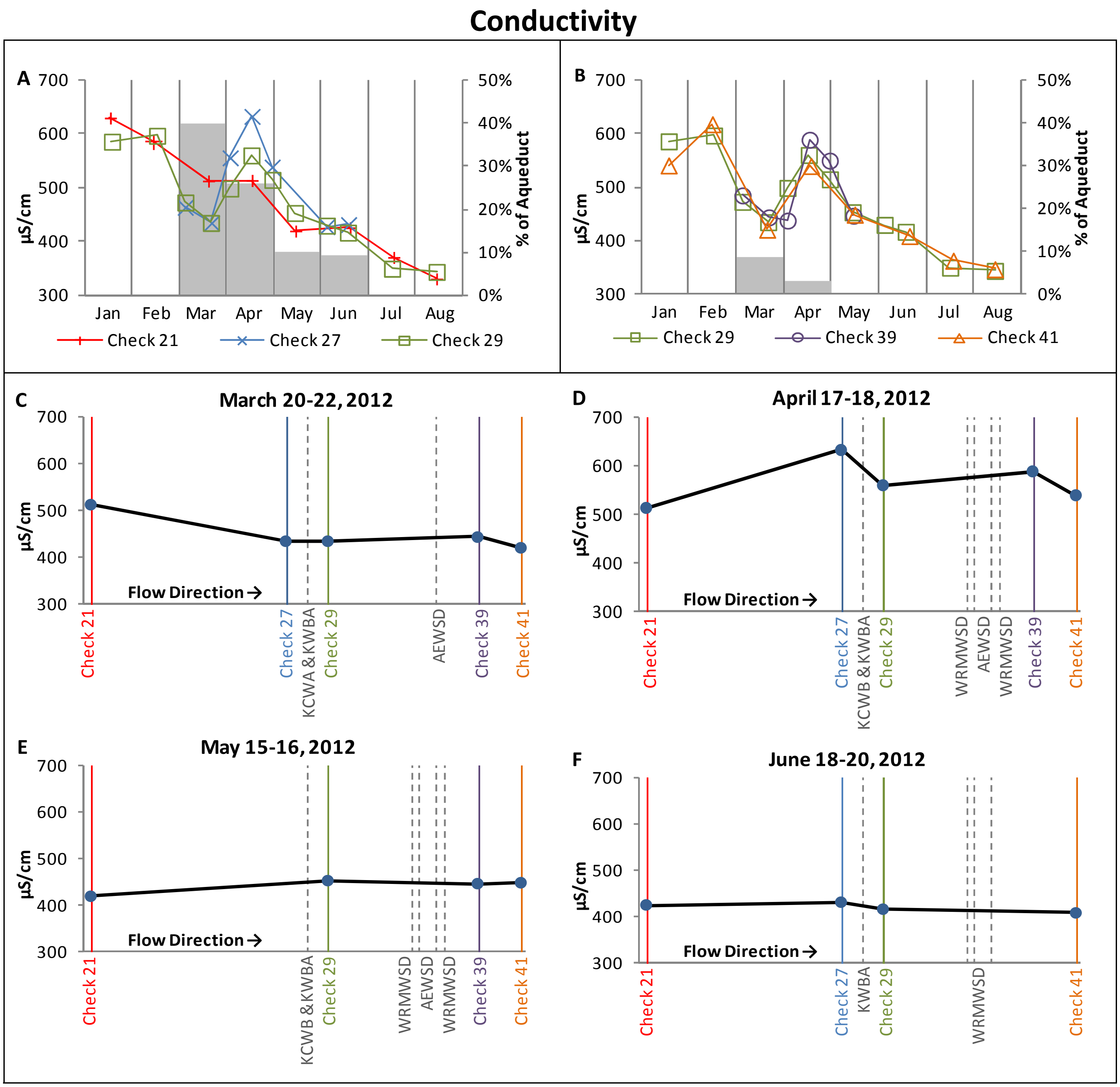

Figure 6. Upstream/Downstream Conductivity Levels in the California Aqueduct

Farther downstream, conductivity increased by 9 to 35 µS/cm (2 to 7%) between Checks 29 and 39 on four sampling dates and declined by 6.5 to 61 µS/cm (-1.4 to -12%) on two dates (Figures 6B-F and Table 4). The changes (increases or decreases) were greatest in the month of April and relatively minor during the other months. AEWSD likely contributed to all or part of the largest decrease of 61 µS/cm recorded in samples collected during the first week of April. Conductivity in this source was 260 µS/cm, lower than at Check 29 (435 to 560 µS/cm) and in WRMWSD wells. The same us/ds samples in early April also recorded a decline in sulfate, DOC, and bromide and an increase in nitrate. These trends were consistent with AEWSD influence regarding concentrations relative to upstream levels in the Aqueduct. Conductivity increases later that same month (April) suggest influence from WRMWSD; conductivity in WRMWSD wells ranged between 460 and 1,700 μS/cm. Influence from AEWSD and/or WRMWSD turn-ins was not expected to be significant during the months of May and June due to the low dilution factors (0.22 to 0.29%) and the existing data support this. All us/ds measurements were below the secondary recommended MCL of 900 μS/cm for conductivity in drinking water.

Dissolved Organic Carbon

Turn-ins from CVC and KWBC consistently reduced DOC in the Aqueduct. DOC declined between Checks 27 and 29 on all us/ds sampling dates (Figures 7A, C-D, F, and Table 3). Declines ranged from 0.2 to 1.1 mg/L (-5.3 to -21%), averaging 0.7 mg/L over the four-month turn-in period.

DOC declined by 0.15 to 1.1 mg/L (-3.3 to -33%) between Checks 29 and 39 on five sample dates and increased by 0.3 mg/L (8.6%) on one date (Figures 7B, C-F, and Table 4). Declines were greatest on the early April and mid May sample dates (1.1 and 0.9 mg/L, respectively). The relatively large DOC decline of 0.9 mg/L was not supported by either the monthly dilution factor of 0.22% for May or other COC changes of relatively similar magnitude. Further, the mid May decrease in DOC at Check 39 was not reflected at Check 41 which exhibited a concentration essentially identical to the upstream value at Check 29 (Figure 7E). Although the Check 39 and 41 samples were collected one day apart, possibly accounting for the difference between stations, the evidence suggests that other non-turn-in factors contributed to the lower DOC value at Check 39 in mid May.

Nitrate

Unlike the other parameters previously discussed, turn-ins from CVC and KWBC consistently raised nitrate concentrations in the Aqueduct. Nitrate was higher at Check 29 than Check 27 on all sampling dates by 0.2 to 1.6 mg/L (3 to 100%, Figures 8A, C-D, F, and Table 3). The increases averaged 0.9 mg/L during the four-month period of activity and were greatest during March and early April, overlapping the period when monthly dilution factors were also highest.

Several apparent anomalies were present in the nitrate database during the turn-in period. Dissimilar concentrations of <0.1 and 2.5 mg/L were reported for duplicate samples collected from Check 29 on May 15 (Appendix E), the latter of which was used in the us/ds analysis. The less-than value was an apparent outlier considering surrounding levels in the Aqueduct. The wide disparity in that set was countered by two other pair of duplicates collected from Check 29 on April 17 and June 18, which exhibited differences of only 0.1 mg/L on both occasions.

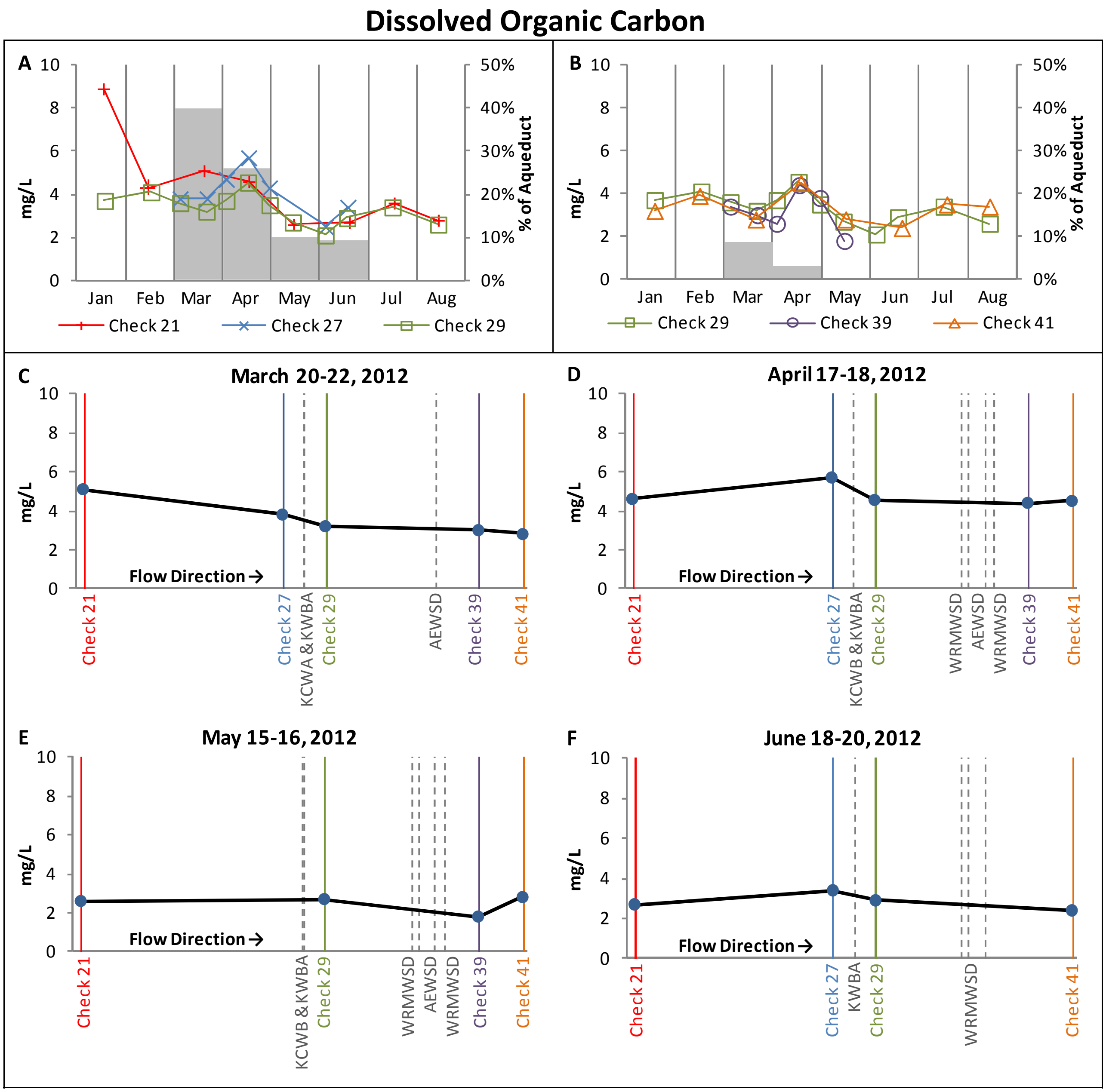

Figure 7. Upstream/Downstream Dissolved Organic Carbon Concentrations in the California Aqueduct

Another sample collected from Check 29 on March 21 produced a nitrate concentration of 5 mg/L, 1.8 mg/L higher than the March 22 value plotted in Figure 8A (Appendix E). For purposes of maintaining a consistent protocol for this assessment, only same-day data was included in the us/ds analysis. The rationale is that, on any given day, flows (Aqueduct or turn-in) may change and potentially affect downstream composition and water quality.

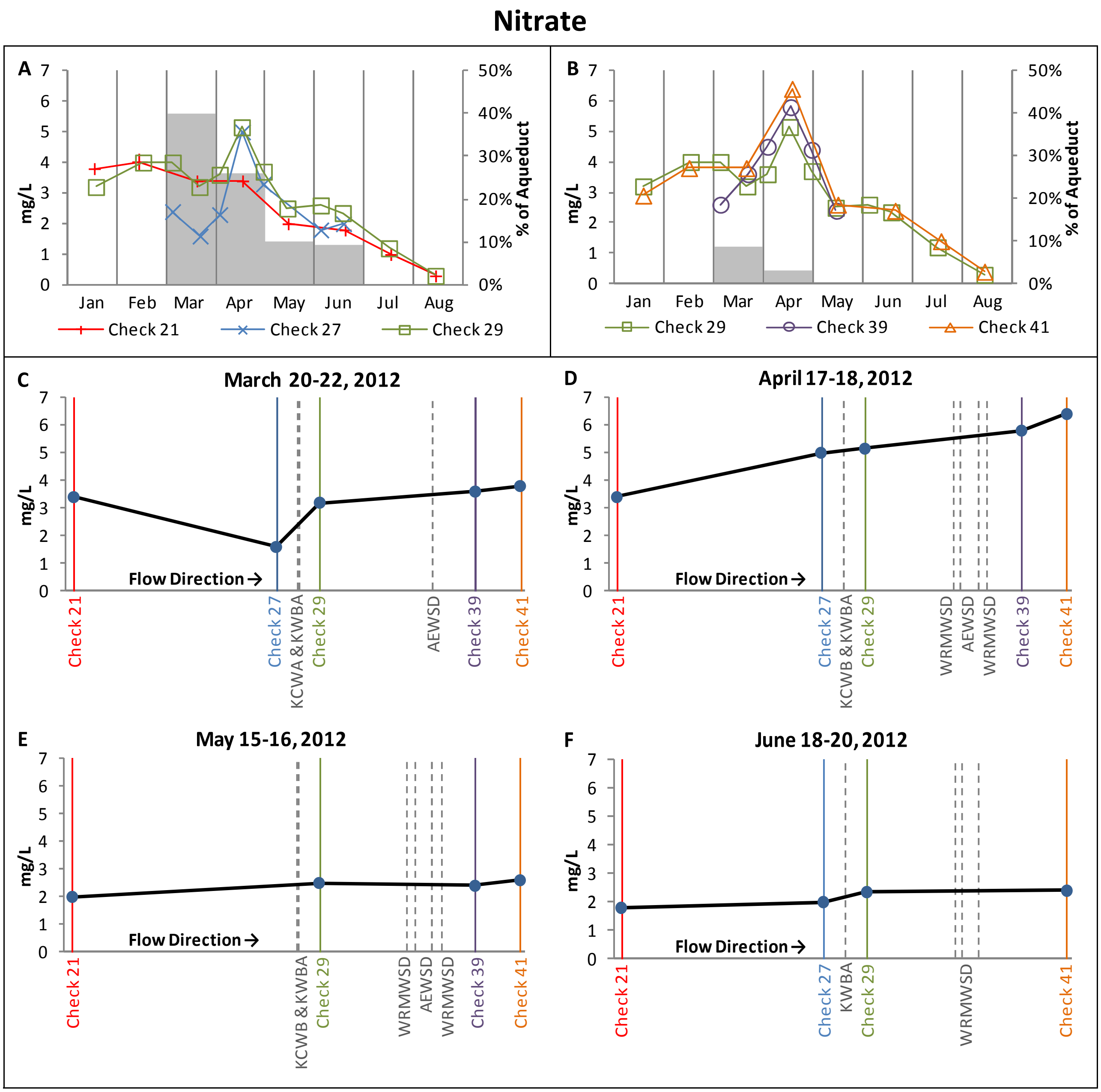

Figure 8. Upstream/Downstream Nitrate Concentrations in the California Aqueduct

Nitrate between Checks 29 and 39 increased by 0.4 to 0.9 mg/L (12.5 to 25%) on four sampling dates and decreased by 0.1 and 1.4 mg/L (-4 to -35%) on two dates (Figures 8B-E and Table 4). Increases were not unexpected because levels in the Aqueduct (2.5 to 5.2 mg/L) ranged below the AEWSD average of 5.9 mg/L. A wider range of concentrations was reported for WRMWSD wells extending from below detection (<1 mg/L) to 130 mg/L. The large decline of 1.4 mg/L in early March defied expected trends with respect to these turn-ins. The decline was not accompanied by changes in any other COC of relatively similar magnitude. One or both of the us/ds samples collected on this date may have been plagued by the same anomalies previously discussed above for the duplicates collected at Check 29.

Nitrate concentrations in May were within 0.2 mg/L at all three stations (Checks 29, 39, and 41) despite sampling that occurred one day apart between Check 41 and the other stations (Appendix E). This and the small dilution factor of 0.22% indicate little influence from turn-ins on nitrate concentrations for those dates. Nitrate also changed very little between Checks 29 and 41 in the mid June samples. All us/ds results were below the primary MCL of 45 mg/L for nitrate in drinking water.

Sulfate

Sulfate between Checks 27 and 29 increased by 1 to 3 mg/L (3 to 8%) on four sampling dates and declined by 1 to 8 mg/L (-2 to -12%) on three dates (Figures 9A, C-D, F, and Table 3). Declines occurred during April when concentrations in the Aqueduct had peaked while increases occurred during March and June when concentrations were below peak levels in April. These trends illustrate that the us/ds increases or decreases were predicated on background levels in the Aqueduct; sulfate was reduced with background levels $\geq$ 50 mg/L and augmented with background levels $\leq$ 37 mg/L. This consistent trend was unique among the other COCs and can be explained by turn-in concentrations (35 to 56 mg/L) that were comparable to Aqueduct levels in the middle to lower range (35 to 68 mg/L). Although conductivity also exhibited us/ds declines in April, only nominal increases or no changes were recorded outside of that month.

Sulfate between Checks 29 and 39 decreased by 1.5 to 5 mg/L (-4 to -11%) on three sample dates, increased by 6 mg/L (10 to 11%) on two dates, and was the same on one (Figures 9B-E and Table 4). AEWSD most probably caused the reductions; the average concentration in this turn-in was 17 mg/L versus an Aqueduct average of 45 mg/L. On the two dates with increases, the low sulfate waters from AEWSD may have been countered by WRMWSD inflows that began in April. Sulfate in WRMWSD wells ranged from 24 to 740 mg/L with an overall average of 326 mg/L. All us/ds analyses were below the secondary recommended MCL of 250 mg/L for sulfate in drinking water.

Total Dissolved Solids

With a few minor exceptions, us/ds trends in TDS (Figure 10) were essentially similar to those for conductivity discussed above. All us/ds analyses were below the secondary recommended MCL of 500 mg/L for TDS in drinking water.

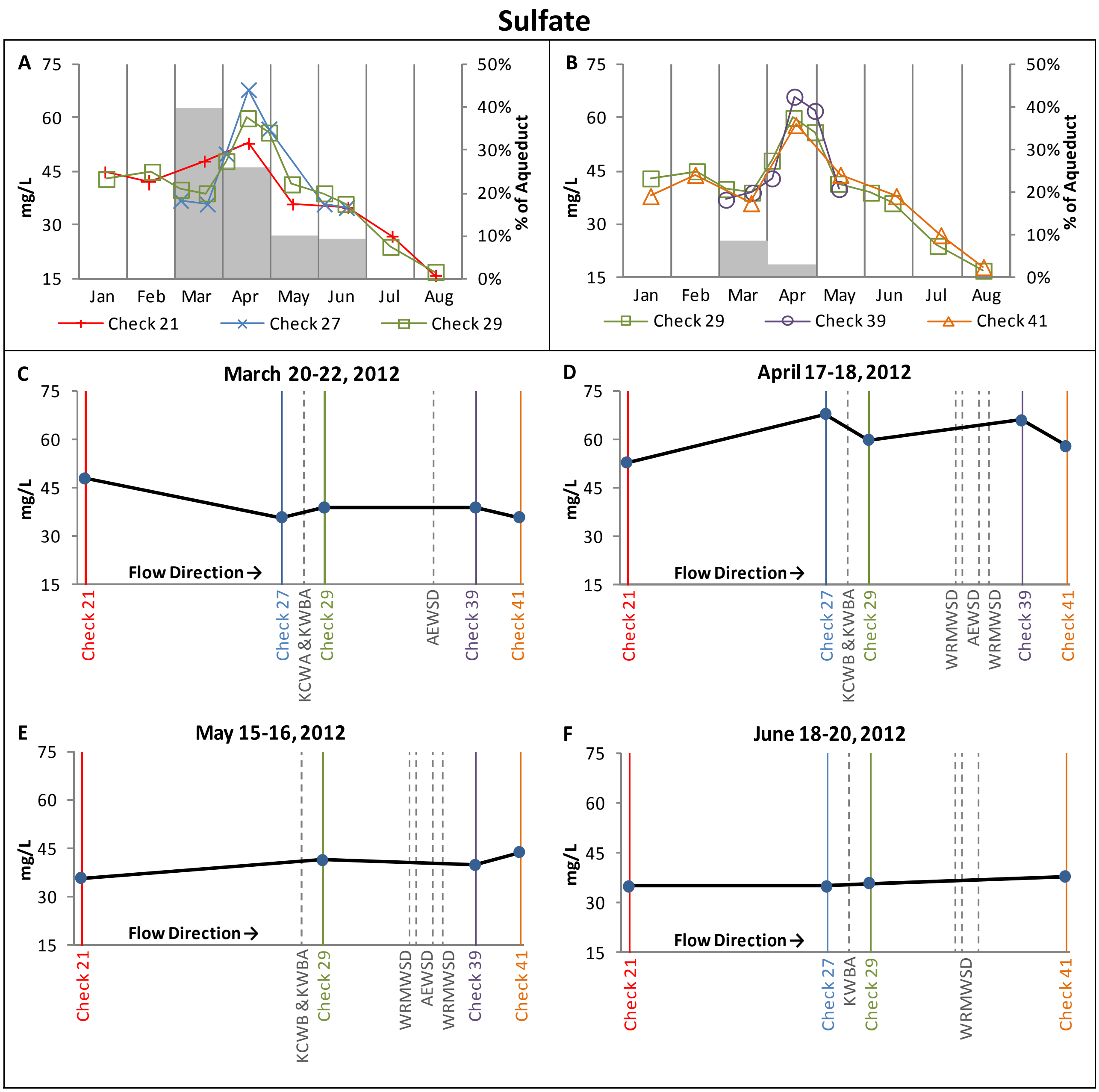

Figure 9. Upstream/Downstream Sulfate Concentrations in the California Aqueduct

December

Turn-ins from KWBC were restarted on December 7 at an initial flow rate of 310 cubic feet per second (cfs). Inflows continued throughout the month and into the following year (turn-ins during 2013 will be addressed in a future report). The total inflow volume of 14,395 af for December comprised 19.7% of the Aqueduct flow-volume. This dilution factor was calculated

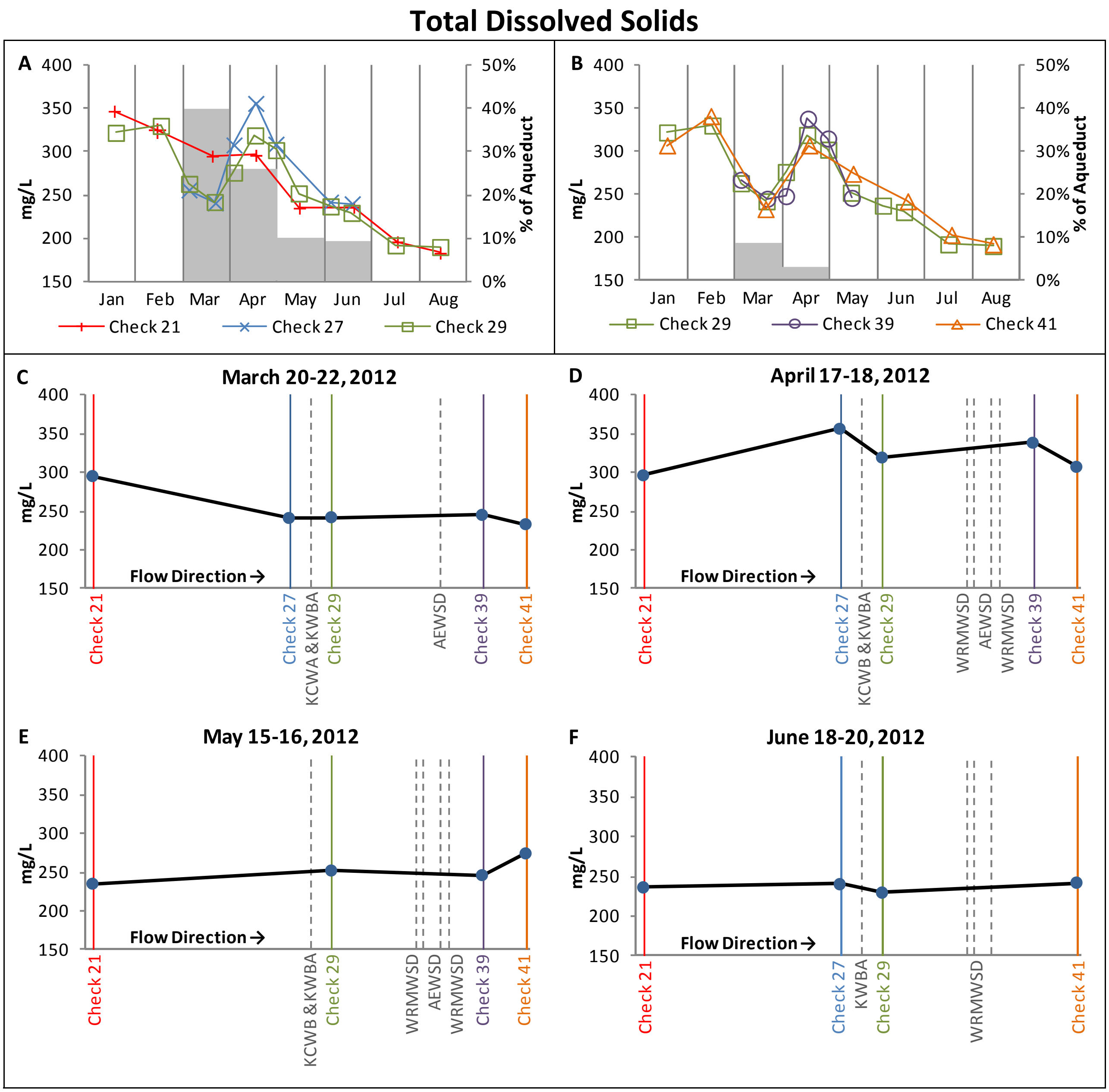

Figure 10. Upstream/Downstream Total Dissolved Solids Concentrations in the California Aqueduct

with pumping at Buena Vista Pumping Plant from December 7th on plus deliveries between the turn-in and the pumping plant (see the Table 1 endnotes for the calculation method).

COCs in KWBC and the us/ds assessment in the Aqueduct are presented in Table 5. Chloride and chromium (total and hexavalent) were added to the list of original COCs. Detailed water quality data for KWBC are presented in Appendices F and G.

Table 5. Constituents-of-Concern in Kern Water Bank Canal and Upstream/Downstream in the California Aqueduct during December (values in milligrams per liter [mg/L] unless specified)

Location	Data Source	Sample Date	Arsenic		Bromide	Chloride	Chromium	Hexavalent Chromium (µg/L)	Conductivity (µS/cm)	Nitrate (as NO_3)	Sulfate	DOC a/	TOC b/	TDS c/
KWBC	DWR	12/12/2012	0.002	**	0.2	52	0.001	0.97***	474	7.8	50	<0.5	<0.5	265
	KCWA	12/11/2012	0.00094	*	0.22	53	NA	0.82	465	8.1	48	NA	0.85	290
Tupman Rd (us)	KCWA	12/11/2012	0.0012	*	0.27	76	NA	0.041	472	4.4	33	NA	2.7	260
Cole's Levee (ds)	KCWA	12/11/2012	0.0013	*	0.27	82	NA	0.28	475	3.1	29	NA	2.3	270
Percent Change			8.3		0.0	7.9		583	0.6	-30	-12		-15	3.8
Check 27 (us)	DWR	12/12/2012	0.002	**	0.24	78.5	<0.001	<0.3	463	2.8	28	2.4	NA	258
Check 29 (ds)	DWR	12/12/2012	0.002	**	0.24	75	<0.001	<0.3	474	3.6	34	1.9	NA	262
Percent Change			0.0		0.0	-4.5	0.0	0	2.4	29	21	-21		1.6
Check 27 (us)	DWR	12/18/2012	0.002		0.27	85	<0.001	NA	500	3.66	33	2.6	NA	275
Check 29 (ds)	DWR	12/18/2012	0.002		0.28	80	<0.001	NA	492	4.42	35	3.2	NA	272
Check 29 (replct.)	DWR	12/18/2012	0.002	**	0.25	79	<0.001	NA	490	3.89	35	2.2	2.3	273
Check 29 Average			0.002		0.265	79.5	<0.001		491	4.155	35	2.7		272.5
Percent Change			0.0		-1.9	-6.5	0.0		-1.8	14	6.1	3.8		-0.9

* Total recoverable; ** Total recoverable and dissolved; *** Average of triplicates (0.95-0.98 µg/L)
a/ DOC=dissolved organic carbon; b/ TOC=total organic carbon; c/ TDS=total dissolved solids

Arsenic in KWBC differed between analytical labs: 0.002 mg/L in one sample collected on the 12th and analyzed by DWR's Bryte Lab versus 0.00094 mg/L submitted by KCWA from one sample collected on the 11th and analyzed by BC Laboratories, Inc. (Bakersfield, Calif.). The 0.002 mg/L value represents both dissolved and total results while the KCWA value represents total recoverable only. One of the labs either under- or over-reported arsenic, assuming no change in concentration between sampling dates.

Arsenic concentration differences between the two labs were less considerable for Aqueduct samples. In one set of us/ds samples, KCWA reported an increase of from 0.0012 to 0.0013 mg/L. Aqueduct concentrations from DWR were 54 to 67% higher. DWR reported an arsenic concentration of 0.002 mg/L at both us/ds stations on two sampling dates. Arsenic was static at 0.002 mg/L for three consecutive months at Checks 21 and 29, indicating unchanging concentrations flowing down the Aqueduct prior to, and within, the turn-in period based on DWR results (Figure 11). The data suggest that the concentration differences were possibly more induced by laboratory or field methodology than changing Aqueduct conditions.

Overall, the arsenic results from DWR were consistently higher for turn-in and Aqueduct waters than that provided by the KCWA lab by 0.0007 to 0.0011 mg/L (54 to 113%). However, none of the samples from the duel lab analyses were collected at the same time. The potential exists that this may explain the differences, as arsenic may have varied between sample dates due to changes in influencing factors (flows and concentrations).

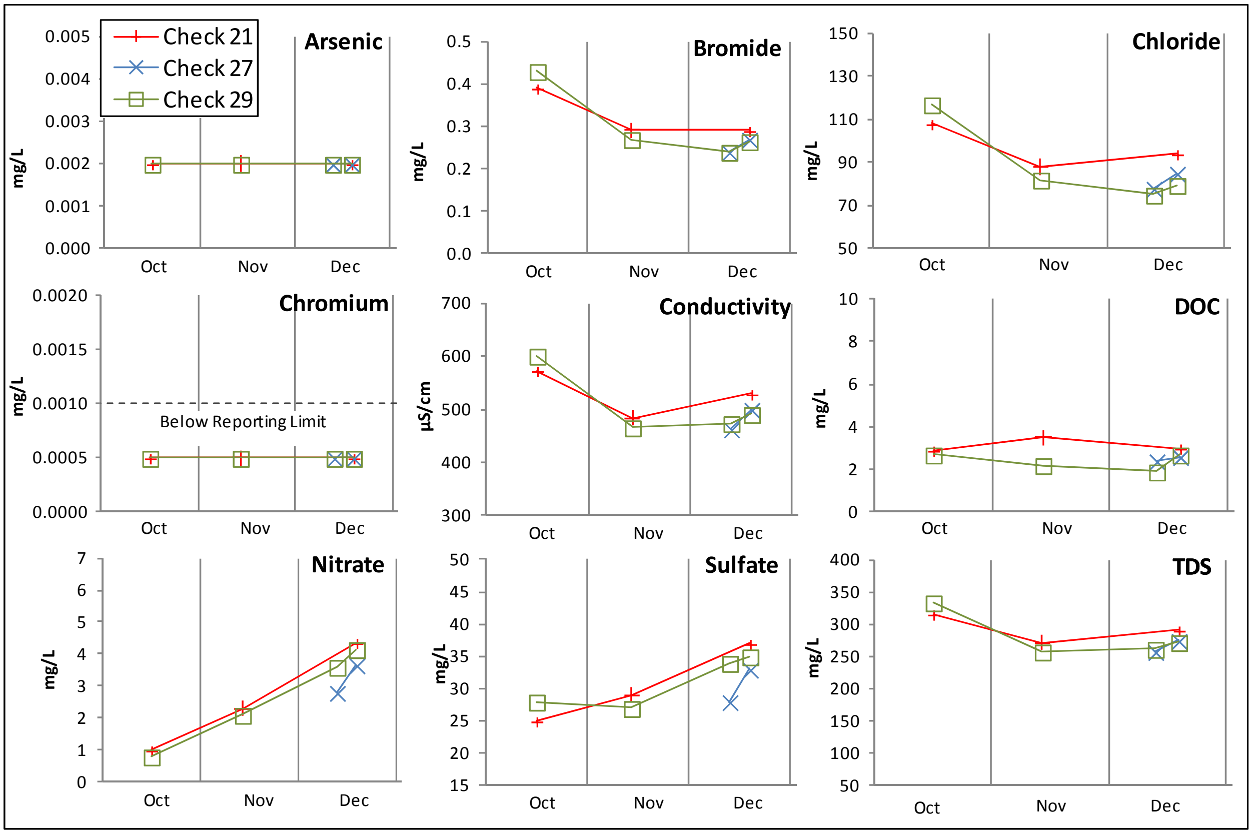

Figure 11. Upstream/Downstream Constituents-of-Concern in the California Aqueduct

Other COCs in KWBC were at or below background levels in the Aqueduct with the exception of hexavalent chromium, nitrate, sulfate, and, to a certain extent, salinity (Table 5). Hexavalent chromium ranged from 0.82 to 0.97 micrograms per liter (µg/L) in KWBC, accounting for most of the total chromium concentration of 0.001 mg/L. Hexavalent chromium increased from 041 to 0.28 µg/L in the Aqueduct from one set of us/ds samples with low reporting limits. The relative percent increase of 583% appeared to be inordinately high compared to that for the other parameters. However, the turn-in concentration was higher than the background Aqueduct concentration by more than an order of magnitude. All analyses were above the PHG of 0.02 µg/L for hexavalent chromium in drinking water. The PHG is a level of drinking water contaminant at which adverse health effects are not expected to occur from a lifetime of exposure (OEHHA, 2007). Total chromium was below the reporting limit of <0.001 mg/L in all us/ds samples, and thus below the primary MCL of 0.05 mg/L for this parameter in drinking water.

The nitrate database showed evidence of apparent anomalies. Nitrate averaged 7.95 mg/L in KWBC, more than twice the average of 3.62 mg/L upstream in the Aqueduct during the turn-in period. However, nitrate increased in the Aqueduct on only two of three sampling dates. Further, field duplicates collected at Check 29 on December 18 exhibited somewhat dissimilar levels of 3.89 and 4.42 mg/L, although both duplicates (averaging 4.16 mg/L) were higher than the upstream concentration of 3.66 mg/L. More noteworthy was the magnitude of conflicting concentration changes on individual sample dates. Samples collected on December 11 and 12 registered opposing nitrate changes of -30 and 29%, respectively. The conflicting trends were largely the result of widely differing upstream concentrations of 4.4 and 2.8 mg/L. Because of the aforementioned concentration discrepancies, the existing data may be considered somewhat unreliable for providing strong evidence of consistent trends. All analyses were below the primary MCL of 45 mg/L for nitrate in drinking water.

Similar to nitrate, sulfate increased in the Aqueduct on two sets of us/ds sampling dates (6.1 to 21%) and decreased on one (-12%). The increases can be explained by an average concentration of 49 mg/L in KWBC that was higher than the average of 31.3 mg/L in the Aqueduct during the turn-in period. All analyses were below the recommended secondary MCL of 250 mg/L for sulfate in drinking water.

Conductivity and TDS increased in the Aqueduct on two sampling dates and decreased on one. The relative magnitude of these changes was small, ranging from -1.8 to 3.8%. All analyses of conductivity and TDS were below the recommended secondary MCLs of 900 µS/cm and 500 mg/L, respectively, for these parameters in drinking water.

Chloride and organic carbon were consistently lower in KWBC than in the Aqueduct. The us/ds sampling dates for these COCs registered two decreases and one increase. One set of field duplicates for DOC at Check 29 exhibited concentrations 1 mg/L apart (2.2 versus 3.2 mg/L), producing an average of 2.7 mg/L that was nominally higher than the upstream sample (2.6 mg/L). However, TOC was 2.3 mg/L in one of the duplicates, implying that the DOC duplicate concentration of 3.2 mg/L was unusually elevated and possibly an outlier. For this assumption, us/ds organic carbon concentrations declined on all three sampling dates, an outcome that is compatible with the much lower concentrations in KWBC than the Aqueduct. All analyses for chloride were below the recommended secondary MCL of 250 mg/L for this parameter in drinking water.

Bromide was slightly lower in KWBC than in the Aqueduct and us/ds sampling registered minimal to no changes (-1.9 to 0.0%). No MCL exists for this parameter.

IV. San Luis Field Division

Non-Project water from two separate turn-ins was accepted into the State Water Project (SWP) within the San Luis Field Division during 2012. Inflows to the Aqueduct from a single well occurred during late August to early September. Inflows to the Aqueduct during December originated from Sierra Nevada flood flows in the Kings River watershed. Kings River water was routed to the Mendota Pool, then pumped out and conveyed via pipeline to the Aqueduct. Inflows during August through September are presented first followed by the December inflows.

August-September

San Luis Water District (SLWD) requested a temporary contract to pump up to 1,500 af of groundwater into the Aqueduct in exchange for Central Valley Project water delivered from San Luis Reservoir. On August 22, groundwater began entering the Aqueduct at mile post (MP) 79.67, as per the contract agreement (Reclamation, 2012A). The groundwater originated from a well operated by Bettencourt Farms, located 0.22 mile east of the input point.

Pumping from the wellhead was constant from startup on August 22 to shutdown 17 days later, on September 7. Daily inflows to the Aqueduct ranged from 2.8 to 4.0 cfs, with a final total volume of 111 af. The shutdown prior to reaching the 1,500 af goal resulted from continuing water quality issues (discussed below). Flow in the Aqueduct was relatively high during the same period, ranging from 5,250 to 7,557 cfs at Dos Amigos Pumping Plant, resulting in daily pump-in dilution factors of approximately between 0.01 and 0.07%.

The potential for impacts on Aqueduct water quality was considered low owing to the small rate of pumpage relative to Aqueduct flows. Regardless, weekly monitoring was initiated because of the relatively saline nature of the well and the potential for well water composition to change with continued pump run-time. The monitoring strategy aimed to track any changes in discharge quality after startup and document us/ds water quality in the Aqueduct during the inflow period.

SLWD provided water quality data from wellhead sampling before inflows to the Aqueduct began. The analyses were performed by BSK Associates Engineers and Laboratories (Fresno, Calif.). DWR collected startup samples from the inflow site at MP 79.67 on the day the pump-in became active. Startup samples were analyzed by DWR for a full suite of parameters including major minerals, physical parameters (e.g., pH, conductivity, and turbidity), metals, DOC/TOC, and nutrients. Subsequent samples from pumpage were analyzed for the COCs conductivity, TDS, bromide, chloride, sulfate, nitrate, arsenic, DOC, and chromium by DWR. Upstream/downstream samples in the Aqueduct were collected at O'Neill Forebay Outlet (MP 70.89) and just downstream from Dos Amigos Pumping Plant (MP 88.51). COCs are presented in Table 6 while detailed water quality analyses are presented in Appendices H and I.

With the exception of DOC, COCs were higher in the pump-in than the Aqueduct. Arsenic ranged from 0.0039 to 0.006 mg/L in four pump-in samples, while in the Aqueduct it was 0.002 mg/L in all us/ds samples (Table 6). Nitrate ranged from 5.5 to 8.5 mg/L in pumpage versus an average of 0.45 mg/L in the Aqueduct. Bromide was also relatively high, with concentrations ranging from 1.4 to 1.82 mg/L.

Table 6. Constituents-of-Concern in San Luis Water District Pump-in at MP 79.67 and Upstream/Downstream in the San Luis Canal at MPs 70.89 and 88.51 (values in milligrams per liter [mg/L] unless specified)

Location *	Sample Date	Arsenic	Bromide	Chloride	Chromium	Conductivity (µS/cm)	Nitrate (as NO_3)	Sulfate	DOC a/	TOC b/	TDS c/
Wellhead	8/3/2012	0.0039	1.4	320	<0.0001	1,400	8	110	NA	<0.2	840
GKA07967r	8/22/2012	0.006	1.50	306	0.003	1,558	8.5	110	<0.5	0.9	876
	8/30/2012	0.006	1.82	378	0.005	1,634	6.7	108	0.8	NA	1000
	9/5/2012	0.006	1.74	394	0.005	1,759	5.5	109	<0.5	NA	1030
KA007089	8/30/2012	0.002	0.26	69	0.002	365	0.5	20.5	3.4	NA	205
KA008851	8/30/2012	0.002	0.19	66	0.002	372	0.5	21	3.15	NA	204
Percent Change		0.0	-26.9	-4.3	0.0	1.9	0.0	2.4	-7.4		-0.5
KA007089	9/5/2012	0.002	0.22	76	<0.001	411	0.4	19	2.5	NA	227
KA008851	9/5/2012	0.002	0.23	72	<0.001	401	0.4	19	2.4	NA	224
Percent Change		0.0	4.5	-5.3	0.0	-2.4	0.0	0.0	-4.0		-1.3

* Source: DWR except for 8/3/2012 (SLWD, BSK Labs)
a/ DOC=dissolved organic carbon; b/ TOC=total organic carbon; c/ TDS=total dissolved solids

With continued pumping, several of the COCs in pumpage increased above, or did not decline below, upper limit standards listed in the contract for acceptance of pump-in water into the Aqueduct. The contractual standard for conductivity was 1,600 µS/cm. Conductivity increased from 1,400 µS/cm before startup to 1,759 µS/cm in the final sample (Figure 12). According to the contract agreement (Reclamation 2012A): "Non-project water must meet the standards listed in Table 5 (of the contract). The list has been developed by Reclamation and DWR to measure constituents of concern that would affect downstream water users." The 1,600 µS/cm standard had been exceeded in a discrete sample collected eight days after startup (Figure 12). However, a linear regression of the post-startup data estimated that the standard was

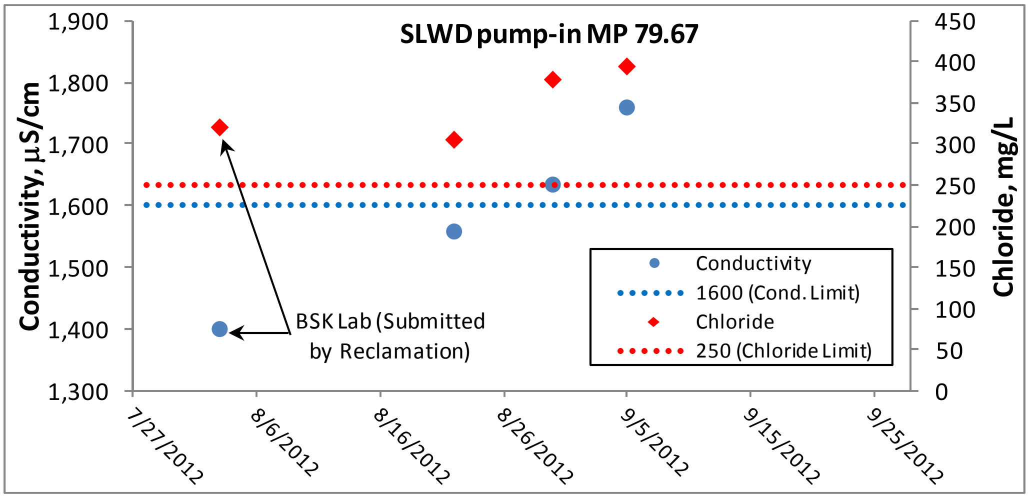

Figure 12. Conductivity and Chloride in Pump-in to the San Luis Canal at MP 79.67

exceeded four days after startup — when conductivity was 1,558 µS/cm — rising at a rate of 14.1 µS/cm per day.

Both chloride and sodium were also above the contractual acceptance standards in all samples. Chloride ranged from 306 to 394 mg/L before and after startup, above the recommended secondary MCL standard of 250 mg/L. The standard of 69 mg/L for sodium was exceeded in all samples (200 and 209 mg/L). Therefore, both of these constituents did not decline below the acceptance standards with continued pumping and, in the case of chloride, showed a definitive increasing trend (Figure 12).

Arsenic in pumpage increased from 0.0039 mg/L before startup to 0.006 mg/L upon startup, and remained at that concentration throughout the duration of pumping. Arsenic is an important drinking water COC because of it's potential human health consequences. Bromide in the pump-in was also elevated at up to 1.82 mg/L. Bromide is a disinfection byproduct precursor and also an important COC to SWP contractors.

Due the relatively high concentrations of undesirable drinking water constituents in the pump-in and exceedance of the acceptance standards for chloride, sodium, and conductivity, the proponents were instructed to shut the well pump off. Within hours of notification, pumping had ceased.

Upstream/downstream sampling in the Aqueduct registered more decreases than increases depending on constituent, which was inconsistent with respect to the relative pump-in concentrations of salinity-related parameters. Moreover, owing to the extremely low dilution factors, measureable changes in water quality were not expected as a result of the pump-in. On August 30, chloride, bromide, and TDS decreased while conductivity and sulfate increased (Table 6). On the September 5 sampling date, chloride, conductivity, and TDS decreased, bromide increased, and essentially no change was recorded for nitrate and sulfate. With the exception of the decline in bromide on August 30, the magnitude of the changes (both increases and decreases) in salt-related parameters were relatively low (-5.3 to 4.5%), possibly implicating simple method precision. Another potential factor accounting for the declines in these parameters was an increasing conductivity trend in the Aqueduct as measured at the O'Neill Forebay Outlet automated water quality monitoring station. At any given time of same-day sample collection, the station farthest upstream would register a higher salinity depending on downstream distance, Aqueduct flow rate, and rate of increase. This provides another influencing factor for the predominance of declining trends in salt-related parameters in the us/ds analysis.

December

Westlands Water District (WWD) requested a five-year contract to allow up to 50,000 af of non-Project surface water from the Kings River into the Aqueduct in exchange for deliveries from San Luis Reservoir (Reclamation, 2012B). WWD has an agreement to purchase and take delivery of Kings River flood flows. This water was conveyed to Mendota Pool and routed by pipeline to the Aqueduct at MP 115.43 (Lateral 7).

On December 21, WWD began inputting water to the Aqueduct at Lateral 7 with inflows continuing into 2013 (turn-ins during 2013 will be addressed in a future report). Daily flows ranged from 45 to 76 cfs with a total volume of 1,166 af for December. Daily dilution factors (using pumpage at Dos Amigos Pumping Plant) ranged from 2.1 to 16.6% with an overall percentage of 7.5% for the month. These percentages are considered underestimates because volumes from active turn-outs between the pumping plant and Lateral 7L were not available on a daily basis and were not included in the calculations.

Lateral 7 was sampled by DWR in the following month, January 2013 — 13 days after startup. The analyses included major minerals, physical parameters (e.g., conductivity, pH, and turbidity), DOC/TOC, and nutrients. One set of us/ds samples for COCs were collected in the Aqueduct at MPs 113.82 and 121.97, bracketing the turn-in by 8.15 miles. The COCs are shown in Table 7 and the full complement of analyses is presented in Appendix J.

Table 7. Constituents-of-Concern in Westlands Water District Turn-in at MP 115.43 and Upstream/Downstream in the San Luis Canal at MPs 113.82 and 121.97 (values in milligrams per liter [mg/L] unless specified)

Location	Sample Date	Arsenic	Bromide	Chloride	Chromium	Conductivity (µS/cm)	Nitrate (as NO_3)	Sulfate	DOC a/	TOC b/	TDS c/
GKA11543	1/3/2013	0.001	0.32	90	<0.001	685	2.4	98	2.9	2.9	398
KA011382	1/9/2013	0.002	0.32	68	<0.001	463	4.5	39	4.7	NA	253
KA012197	1/9/2013	0.002	0.28	70	<0.001	479	4.13	43	4.4	NA	263
Percent Change		0.0	-12.5	2.9	0.0	3.5	-8.2	10.3	-6.4		4.0

With the exception of bromide, water quality changes in the Aqueduct were largely in accordance with relative turn-in and Aqueduct concentrations. Nitrate, arsenic, and DOC were lower in Lateral 7 than the Aqueduct. Nitrate and DOC registered us/ds declines of -8.2 and -6.4%, respectively, while arsenic remained unchanged. COCs that were higher in Lateral 7 included chloride, conductivity, sulfate, and TDS. The us/ds sampling showed that these parameters increased by 2.9 to 10.3%. Some of the changes were low enough to be attributed to precision or changing water quality conditions in the Aqueduct. Bromide decreased by -12.5%, a change not supported by either the turn-in or upstream data, which exhibited the same concentration. A decline in Aqueduct bromide, not associated with other factors such as method precision, could have been caused if there was a decrease in the Lateral 7 concentration between the January 3 and 9 sampling dates.

Acknowledgements

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Appendix A. Department of Water Resources Water Quality Policy and Implementation Process for Acceptance of Non-Project Water into the State Water Project (October 31 2012 Draft).

It is the Department of Water Resources (DWR) policy to assist with the conveyance of water to provide water supply, and to protect the State Water Project (SWP) water quality within the California Aqueduct. To facilitate this policy DWR provides the following implementation process for accepting non-project water into the SWP (Policy). For purposes of this document, SWP and California Aqueduct are interchangeable and the same.

POLICY PROVISIONS

DWR shall consider and evaluate all requests for Non-Project (NP) water input directly into the SWP conveyance facilities based upon the criteria established in this document. NP water shall be considered to be any water input into the SWP for conveyance by the SWP that is not directly diverted from the Sacramento-San Joaquin Delta or natural inflow into SWP reservoirs.
The proponent of any NP water input proposal shall demonstrate that the water is of consistent, predictable, and acceptable quality. DWR will consult with State Water Project (Contractors), existing NP participants and the California Department of Public Health (DPH) on drinking water quality issues relating to NP water as needed to assure the protection of SWP water quality.

Nothing in this document shall be construed as authorizing the objectives of Article 19 of the SWP water supply contracts or DPH drinking water maximum contaminant levels to be exceeded.

This Policy shall not constrain the ability of DWR to operate the SWP for its intended purposes and shall not adversely impact SWP water deliveries, operation or facilities.

EVALUATING NP WATER PROPOSALS

DWR shall use a two-tiered approach for evaluating NP water for input into the California Aqueduct.

NP Tier 1

Tier 1 NP pump-in proposals (PIP) shall exhibit water quality that is essentially the same, or better, than what occurs in the California Aqueduct. PIP's considered to be tier 1 shall be approved by DWR (see baseline water quality tables 1 through 4).

NP Tier 2

Tier 2 PIP's are those that exhibit water quality that is different and possibly worse than in the California Aqueduct and/or have the potential to cause adverse impacts to the Contractors. Tier 2 PIP's shall be referred to a NP Facilitation Group (FG), which would review the project and if needed make recommendations to DWR in consideration of the PIP.

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SWC Facilitation Group

This advisory group consists of representatives from each Contractor that chooses to participate and DWR. The group shall review tier 2 PIP's based on the merits, impacts, mitigation, water quality monitoring, cost/benefits or other issues of each PIP and provide recommendations to DWR. Upon initial review of tier 2 PIP by DWR. It shall then be submitted to the FG for review. A consensus recommendation from the FG would be sought regarding approval of the PIP. DWR shall base its decision on the merits of the PIP, recommendations of the FG and the PIP's ability to provide overall benefits to the SWP and the State of California.

Blending Water Sources

Blending of multiple water sources prior to inflow into the SWP is acceptable and may be preferred depending upon water quality of the PIP. Blending of water in this manner may be used to quality a project as NP Tier 1.

Mixing (blending) within the California aqueduct can be considered but shall not be adjacent to municipal and industrial (M&I) delivery locations. PIP's that are coordinating water discharged to maintain or improve SWP water quality are an example of the mixing approach. The PIP shall demonstrate by model or an approach acceptable to DWR and the FG that the water is adequately mixed before reaching the first M&I customer. Generally NP PIP's that involve mixing with SWP water shall be considered NP Tier 2.

Baseline Water Quality

To aid in developing and evaluating PIP's both historical and current SWP water quality levels shall be considered. A representative baseline water quality summary is shown in Tables 1 through 4, using historical SWP water quality records at O'Neill Forebay.

NP IMPLEMENTATION PROCESS

Project Proposals

The NP project proponent requesting to introduce water into the SWP shall submit a detailed PIP to DWR. The proponent shall demonstrate that the NP water is of consistent, predictable and reliable quality, and is responsible for preparing and complying with any and all contracts, environmental documents, permits or licenses that are necessary consistent with applicable laws, regulations, agreements, procedures, or policies.

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Project Description

The proponent will submit to DWR a PIP describing the proposed program, identifying the water source(s), planned operation, characterizing the inflow water quality and any anticipated impacts to SWP water quality and/or operations. The PIP should be submitted at least one month prior to proposed start up to allow for DWR and FG review. The PIP shall include:

- Project proponent names, locations, addresses, and contact person(s).
- Maps identifying all sources of water, point of inflow to the SWP and ultimate fate of the introduced water.
- Terms and conditions of inflow, timing, rates and volumes of inflow, pumping, conveyance and storage requirements.
- Construction details of any facilities located adjacent to the SWP including valves, meters, and pump and piping size.
- All potential impacts and/or benefits to downstream SWP water contractors.
- Detailed water quality data for all sources of water and any blend of sources that will be introduced into the SWP.
- Identify anticipated water quality changes within the SWP.
- Identify other relevant environmental issues such as subsidence, ground water overdraft or, presents of endangered species.
- Provide performance measures and remedial actions that will be taken in the event projected SWP water quality levels are not met.
- Reference an existing contract or indicate that one is in process with DWR to conduct a PIP.

Water Quality Monitoring

In order to demonstrate that the water source(s) are of consistent, predictable, and acceptable quality the NP proponent shall monitor water quality. The proponent shall, for the duration of the program, regularly report on operations as they affect water quality, monitoring data and water quality changes. Both DPH title 22 and a short list of Constituents of Concern (COC) shall be monitored for based upon one of the following water quality monitoring options.

Constituents of Concern Current COC are Arsenic, Bromide, Chloride, Nitrate, Sulfate, Organic Carbon, and Total Dissolved Solids. These COC's may be changed as needed.

Water Quality Monitoring Options NP proponents shall select one of the testing options below and perform all water quality testing and provide analytical results in a timely manner as described herein. Monitoring shall be conducted for initial well start-up, periodic well re-testing and on-going testing during operation. Well data should be no more than three months old. Title 22 results should be provided to DWR and the FG within two weeks of testing and COC results within one week of testing, unless other schedules are agreed upon by DWR and the FG.

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Option 1 - Baseline tests for Individual Wells

Well Start-up: Title 22 tests are required for all wells participating in the program prior to start-up. An existing title 22 test that is no more than three years old may be used. A Title 22 test may be substituted for any well near a similar well with a Title 22 test of record.

Well Re-testing: Title 22 test for all wells participating every three years.

Ongoing Monitoring: COC tests are required for all discharge locations to the SWP at start up and quarterly thereafter for new programs and resumption of established programs. New programs or those with constituents that may potentially degrade the SWP shall conduct at least weekly COC sampling of all discharge locations until the proponent demonstrates that the NP water is of consistent, predictable and reliable quality. Once the nature of the discharge has been clearly established, the COC tests are required quarterly for each discharge point.

Option 2 - Baseline tests for Representative Wells

Well Start-up: COC tests of record are required for all wells participating in the program and Title 22 tests of record are required for representative wells comprising a subset of all wells. This would typically be a group of wells that are manifold together and discharge to one pipe. Representative wells shall be identified on a case-by-case basis to be representative of the manifold area, well proximity, and water levels.

Well Re-testing: Same as required in Option 1.

On-going Monitoring: COC tests are required for all discharge locations to the SWP at start up and monthly thereafter for the duration of the program and annually at each well. New programs or those with constituents that may potentially degrade the SWP shall conduct weekly COC sampling of all discharge locations until the proponent demonstrates that the NP water is of consistent, predictable and reliable quality.

Option 3 – Self Directed

A PIP may propose a water quality monitoring program for approval by DWR and the FG that is different from options 1 or 2. It must include COC and title 22 testing that will fully characterize water pumped into the SWP and be at an interval to show a consistent, predictable and reliable quality.

Analytical Methods

Analytical laboratories used by project proponents shall be DPH certified by the Environmental Laboratory Accreditation Program (ELAP) and use EPA prescribed and ELAP accredited methods for drinking water analysis. Minimum Reporting Levels must be at least as low as the DPH required detection limits for purposes of reporting (DLR). The current DLRs are listed on the DPH website at Http://www.cdph.ca.gov/certlic/drinkingwater/Pages/MCLsandPHGs. DWR shall continue to use Bryte Chemical Laboratory as it's analytical and reference lab.

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Flow Measurements

The project proponent shall maintain current, accurate records of water production rate and volume from each source, as well as, each point of discharge into the SWP. All flow measurements shall be submitted to regularly to DWR.

RECONSIDERATION

If an NP proponent disagrees with the FG or DWR decision or feels that there is an overriding benefit of the proposal, the proponent may request reconsideration from DWR on the basis of overriding public benefit or water supply deficiency. DWR shall consider these requests on a case-by-case basis.

ONGOING PROGRAM

Any NP Proponent who has successfully established a NP water inflow program (Including existing Kern Fan Banking Projects, Kern Water Bank, Pioneer and Berrenda Mesa Projects, Semitropic Water Storage District Wheeler Ridge Mariposa Water Storage District and Arvin Edison Water Storage District) may reinitiate the program by notifying DWR at least ten days before inflow is scheduled to begin and provide the following information:

- Updated water quality data and/or updated modeling that adequately reflects the quality of water to be introduced into the SWP.
- Turn-in location.
- Expected rate and duration of inflow. DWR shall notify the FG of this reinitiating of inflow.
- Water quality monitoring schedule that meets the objective of this policy.

FUTURE NP PROGRAMS

Future NP projects should be planned and designed considering the following items:

- Projects involving water quality exceeding primary drinking water standards shall show that the water shall be treated or blended before it enters the SWP to prevent water quality impacts.
- The project proponent of a Tier 2 proposal should clearly identify and establish that water inflow shall be managed and operated such that poor quality water will be blended with better quality water so that SWP water quality will not be degraded upon acceptable levels as determined by the FG and DWR.
- If a significant water supply deficiency exists and it is recommended by the FG that raw water quality criteria be set aside to ensure adequate supply, such action shall be subject to approval by the DPH.
- The project proponent of a NP inflow program which degrades SWP water quality shall identify mitigation to downstream water contractors for water quality impacts associated with increased water supply or treatment costs.

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DWR ROLE

DWR shall seek, as needed, DPH or SWC recommendations on changes or additions to this document governing the NP water quality projects. The FG shall review proposed changes or additions prior to implementation by DWR, as needed.

DWR and or the United States Bureau of Reclamation (for San Luis Canal inflow) shall have ultimate responsibility for approving the water quality of all NP inflow, as well as, the oversight of monitoring and tracking the water quality of operating programs. DWR shall also ensure that the proponents of the NP inflow program perform according to their proposals, and will take appropriate action in the event of non-conformance.

Project Proposal Review Process

Upon receipt of a proposal for PIP, DWR shall review it for adequacy. DWR shall consider all PIPs based upon these guidelines. Review shall take no more than one month after receiving a complete program proposal. If necessary, DWR will convene timely meetings with the FG during the review. At a minimum the review will include

- Examination of all documents and data for completeness of the PIP.
- Notification of the affected Field Divisions, and the FG has been received by DWR.
- Consideration by DWR of comments from all parties before the final decision.
- Upon completion of the review DWR will notify the proponent and FG of the acceptance of the PIP or explain the reason(s) for rejecting it.
- DWR may reconsider a decision on a PIP based upon a recommendation from the FG. Reconsideration by DWR will be on a case-by-case basis.

<u>Periodic Review</u>

DWR may schedule periodic reviews of each operating NP inflow with input from the FG. As part of the review, program proponents shall provide the following information:

- Summary of deliveries to the Aqueduct.
- Water quality monitoring results.
- Proposed changes in the program operation.

The review may result in changes in monitoring and testing required of the program proponent as a result of;

- New constituents being added to the EPA /DPH list of drinking water standards.
- Changes in the maximum contaminant levels for the EPA/DPH list of drinking water standards.
- Identification of new constituents of concern.
- Changes in the water quality provided by the program.
- Changes in constituent background levels in the California Aqueduct.

This procedure shall recognize emerging contaminants and/or those detrimental to agricultural viability as they are identified by the regulatory agencies and shall set appropriate standards for water introduction based upon ambient levels in the California Aqueduct or State Notification

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Levels. Emerging contaminants are those that may pose significant risk to public health, but as yet do not have an MCL. Currently the Office of Environmental Health Hazard Assessment and the DPH establish Public Health Goals and Notification Levels, respectively. These levels, though not regulated, do provide health-based guidance to water utilities and can require public notification if exceeded.

<u>Water Quality Review</u>

DWR shall track and periodically report to the FG on water quality monitoring results on the SWP from NP water inflow and make all water quality data available to the public upon request.

- DWR shall review analyze and maintain all records of water quality testing conducted by the proponent of the well(s), source(s) and discharge(s) into the SWP.
- DWR shall determine what additional water quality monitoring, if any, is necessary within the SWP to ensure adequate protection of SWP water quality. DWR shall conduct all water quality monitoring within the SWP.
- DWR may prepare periodic reports of NP projects.

<u>On-site Surveillance</u>

The appropriate Field Division within DWR will be responsible for review and approval of all construction activities within the SWP right-of-way. Plans showing he discharge system piping, valves, sampling point, meters and locations must be submitted and approved prior to any construction. In addition, the appropriate Field Division will be responsible for confirmation of all meter readings and water quality monitoring conducted by the proponent.

Appendix A (Con't).

Table A1 HISTORICAL WATER QUALITY CONDITIONS 1988 TO 2011 AT O'NEILL FOREBAY OUTLET (mg/L)

Parameter	Mean	Min.	Max.	Std. Dev.
Aluminum	0.03	0.01	0.527	0.05
Antimony	0.002	0.001*	0.005	0.002
Arsenic	0.002	0.001	0.004	0.001
Barium	0.05	0.05	0.068	0.002
Beryllium	0.001*	0.001*	0.001*	0.000
Bromide	0.22	0.04	0.54	0.16
Cadmium	0.003	0.001	0.005	0.002
Chromium	0.004	0.001	0.011	0.002
Copper	0.004	0.001	0.028	0.003
Fluoride	0.1	0.1	0.5	0.1
Iron	0.037	0.005	0.416	0.050
Manganese	0.009	0.005	0.06	0.007
Mercury	0.001	0.0002	0.001	0.0004
Nickel	0.001	0.001	0.004	0.0005
Nitrate	2.9	0.2	8.1	1.6
Selenium	0.001	0.001	0.002	0.0001
Silver	0.003	0.001	0.005	0.002
Sulfate	42	14	99	15
Total Organic Carbon	4.0	0.8	12.6	1.6
Zinc	0.007	0.005	0.21	0.01

*These values represent reporting limits. Actual values would be lower.

Appendix A (Con't).

Table A2 O'Neill Forebay Outlet Total Dissolved Solids Criteria by Water Year Classification, 1988-2011 (mg/L)

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	227.2	262.5	295.4	228.9	213.8	231.2	184.4	226.5	181.5	171.4	195.7	157.3
Near Normal	317.9	324.7	351.7	295.4	268.1	302.7	270.0	285.1	230.1	211.9	170.9	202.6
Dry	286.4	319.6	370.0	362.0	344.2	305.2	240.4	278.2	307.3	234.8	269.0	336.6
Critical	256.6	312.9	372.9	367.0	361.0	335.0	307.1	291.8	335.1	325.7	339.4	328.8

* Year type is based on water year classification. Below normal and above normal year types have been combined into one designation called "near normal."

Table A3 O'Neill Forebay Outlet Bromide Criteria by Water Year Classification, 1988-2011 (mg/L)

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	0.19	0.24	0.28	0.13	0.10	0.12	0.12	0.17	0.12	0.12	0.13	0.10
Near Normal	0.31	0.31	0.34	0.21	0.15	0.15	0.18	0.22	0.15	0.15	0.14	0.19
Dry	0.25	0.29	0.35	0.35	0.24	0.20	0.17	0.24	0.27	0.13	0.29	0.41
Critical	0.26	0.28	0.32	0.37	0.33	0.27	0.22	0.22	0.28	0.28	0.32	0.37

* Year type is based on water year classification. Below normal and above normal year types have been combined into one designation called "near normal."

Table A4 O'Neill Forebay Outlet Total Organic Carbon Criteria by Water Year Classification, 1988-2011 (mg/L)

Year Type*	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Wet	2.8	2.9	3.9	5.2	4.8	3.8	3.9	3.4	3.1	3.2	3.1	2.7
Near Normal	3.7	4.1	4.0	7.0	6.3	5.6	4.7	4.4	4.0	3.3	3.3	3.4
Dry	3.0	3.0	4.0	5.7	4.8	5.7	4.5	3.6	3.7	2.9	2.9	2.7
Critical	2.8	3.1	3.3	4.9	6.0	5.7	4.7	4.0	3.8	3.9	4.0	3.5

* Year type is based on water year classification. Below normal and above normal year types have been combined into one designation called "near normal."

Appendix B. Detailed Turn-in Water Quality Data, DWR

	3/5/2012			6/4/2012			
Analyte	CVC	KWBC	AEWSD	KWBC	Rpt. Limit	Units	Method
Conductance (EC)	415	492	290	448	1	µS/cm	Std Method 2510-B
Dissolved Aluminum	< R.L.	< R.L.	< R.L.	0.063	0.01	mg/L	EPA 200.8 (D)
Dissolved Ammonia	0.01	0.02	< R.L.	< R.L.	0.01	mg/L as N	EPA 350.1
Dissolved Antimony	< R.L.	< R.L.	< R.L.	< R.L.	0.001	mg/L	EPA 200.8 (D)
Dissolved Arsenic	0.003	0.002	0.003	0.003	0.001	mg/L	EPA 200.8 (D)
Dissolved Barium	0.046	0.055	0.058	0.045	0.005	mg/L	EPA 200.8 (D)
Dissolved Beryllium	< R.L.	< R.L.	< R.L.	< R.L.	0.001	mg/L	EPA 200.8 (D)
Dissolved Boron	0.2	0.2	0.1	0.2	0.1	mg/L	EPA 200.7 (D)
Dissolved Bromide	0.16	0.2	0.08	0.21	0.01	mg/L	EPA 300.0 28d Hold
Dissolved Cadmium	< R.L.	< R.L.	< R.L.	< R.L.	0.001	mg/L	EPA 200.8 (D)
Dissolved Calcium	39	48	22	38	1	mg/L	EPA 200.7 (D)
Dissolved Chloride	44	53	20	48	1	mg/L	EPA 300.0 28d Hold
Dissolved Chromium	0.001	0.001	0.002	0.001	0.001	mg/L	EPA 200.8 (D)
Dissolved Copper	< R.L.	0.001	0.001	0.001	0.001	mg/L	EPA 200.8 (D)
Dissolved Hardness	110	128	84	99	1	mg/L as CaCO3	Std Method 2340 B
Dissolved Iron	< R.L.	0.006	< R.L.	0.046	0.005	mg/L	EPA 200.8 (D)
Dissolved Lead	< R.L.	< R.L.	< R.L.	< R.L.	0.001	mg/L	EPA 200.8 (D)
Dissolved Magnesium	3	2	7	1	1	mg/L	EPA 200.7 (D)
Dissolved Manganese	< R.L.	0.007	< R.L.	0.005	0.005	mg/L	EPA 200.8 (D)
Dissolved Mercury	< R.L.	< R.L.	< R.L.	< R.L.	0.0002	mg/L	EPA 200.8 (Hg Dissolved)
Dissolved Nickel	< R.L.	< R.L.	< R.L.	< R.L.	0.001	mg/L	EPA 200.8 (D)
Dissolved Nitrate	7.7	8.6	5.4	7	0.1	mg/L	EPA 300.0 28d Hold
Dissolved Nitrate + Nitrite	1.7	1.6	1.2	1.5	0.01	mg/L as N	Std Method 4500-NO3-F (28Day)
Dissolved Organic Carbon	0.9	1	0.9	< R.L.	0.5	mg/L as C	EPA 415.1 (D) Ox
Dissolved Selenium	0.001	0.001	< R.L.	0.001	0.001	mg/L	EPA 200.8 (D)
Dissolved Silver	< R.L.	< R.L.	< R.L.	< R.L.	0.001	mg/L	EPA 200.8 (D)
Dissolved Sodium	40	48	27	49	1	mg/L	EPA 200.7 (D)
Dissolved Sulfate	37	52	16	56	1	mg/L	EPA 300.0 28d Hold
Dissolved Zinc	< R.L.	< R.L.	< R.L.	< R.L.	0.005	mg/L	EPA 200.8 (D)
Ortho-phosphate	NA	NA	NA	< R.L.	0.01	mg/L as P	Std Method 4500-P, F
pH	8.5	7.9	8.7	8.1	0.1	pH Units	Std Method 2320 B
Total Alkalinity	88	98	90	80	1	mg/L as CaCO3	Std Method 2320 B
Total Dissolved Solids	246	297	165	268	1	mg/L	Std Method 2540 C
Total Kjeldahl Nitrogen	< R.L.	< R.L.	0.1	< R.L.	0.1	mg/L as N	EPA 351.2
Total Organic Carbon	1	1	1	< R.L.	0.5	mg/L as C	EPA 415.1 (T) Ox
Total Phosphorus	< R.L.	< R.L.	0.03	0.01	0.01	mg/L	EPA 365.4
Total Suspended Solids	< R.L.	8	36	5	1	mg/L	EPA 160.2
Turbidity	< R.L.	3	12	3	1	N.T.U.	EPA 180.1
Volatile Suspended Solids	< R.L.	3	7	< R.L.	1	mg/L	EPA 160.4

Appendix C. Detailed Turn-in Water Quality Data, KCWA

Analyte (3/8/2012)	CVC	KWBC	Units
Nitrate	7.9	8.3	mg/L
Sulfate	35	46	mg/L
Total Dissolved Solids	230	270	mg/L
Total Organic Carbon	0.64	0.59	mg/L
Arsenic	3.7	1.9	µg/L
Hexavalent Chromium	0.89	0.86	µg/L
Bromide	190	190	µg/L
Gross Alpha	11.5	14.1	pC/L
Chloride	43	45	mg/L
Orthophosphate	0.13	0.036	mg/L

Appendix D. Detailed Wellhead Water Quality Data, WRMWSD

Well Number	Reach & Milepost	Aqueduct Milepost	Name/Owner	Sample Date	Uranium pCi/L	Ortho-phosphate as P mg/L	Gross alpha activity pCi/L	Ra- 228 pCi/L	Alpha Radium 226 pCi/L	Aluminum mg/L
11N/21W-04L01	R14B-270.24	270.24	WRM-7 Well	4/10/12	2.7	<1.8	2.61	0.488+/-0.509	0.264+/-0.410	<50
11N/21W-04P01	R14B-270.24	270.24	Sun Pacific #6	4/10/12	2.6	<1.2	1.09+/-0.191	0.256+/-.442	0.202+/-.229	<0.050
11N/21W-04R01	R14B-270.24	270.24	Sun Pacific #7	4/25/12	0.98	<1.8	1.56	0.0357+/-0.423	0+/-0.164	<50
11N/21W-10C01	R14B-270.24	270.24	Sun Pacific #8	5/7/12	0.85	<1.8	3.13	0.108+/-0.397	0.335+/-0.260	<50
11N/21W-16E01	R14B-270.24	270.24	WRM 7P-P2	3/8/12	2.9		3.13	0.409+/-0.377	0.406+/-0.347	<50
11N/21W-11D01	R14C-272.31	272.31	Maricopa Orchards	4/10/12	3.6	<1.2				
11N/20W-09R01	R14C-277.28	277.28	Fry	5/17/12	8.7	<1.8	5.73	0.116+/-0.427	-0.058+-0.3	<50
11N/20W-16H01	R14C-277.28	277.28	Fry	5/14/12	6.9	<1.2	6.78	0.131+/-0.437	0+/-0.298	<50
11N/19W-19D01	R14C-280.14	280.14	WRM #A4	3/2/12	10					
11N/19W-19D01	R14C-280.14	280.14	WRM #A4	3/7/12	10		10.9	0.534+/-0.377	0.0+/-0.162	<50
11N/19W-19G01	R14C-280.14	280.14	WRM #A3	3/2/12	11					
11N/19W-19G01	R14C-280.14	280.14	WRM #A3	3/7/12	11		9.9	0.288+/-0.447	0.673+/-0.449	<50
11N/19W-19M01	R14C-280.14	280.14	WRM #A2	3/2/12	13					
11N/19W-19M01	R14C-280.14	280.14	WRM #A2	3/7/12	12		**17.2**	0.399+/-0.335	0.380+/-0.418	<50
11N/19W-19P01	R14C-280.14	280.14	WRM #A1	3/2/12	11					
11N/19W-19P01	R14C-280.14	280.14	WRM #A1	3/7/12	13		10.4	0.0654+/-0.128	1.07+/-0.463	<50
11N/19W-22N01	R14C-280.14	280.14	MOC #B4 aka MOC 3012	4/11/12	1.9	<0.6	2.61	0.576+/-0.391	0.309+/-0.285	<50
11N/19W-22R01	R14C-280.14	280.14	MOC #B5	4/12/12	2.4	<0.6	3.13	0.502+/-0.447	0.187+/-0.237	<50
11N/19W-27C01	R14C-280.14	280.14	WRM #PB-1	3/2/12	1.9					
11N/19W-27C01	R14C-280.14	280.14	WRM #PB-1	3/14/12	2.1	<0.6	2.09	0.368+/-0.319	0.451+/-0.587	<50
11N/19W-27N01	R14C-280.14	280.14	WRM #B2	3/7/12	1.1		ND	0.0721+/-0.390	0+/-0.235	<50
11N/19W-28G01	R14C-280.14	280.14	WRM #B1	3/20/12	7.3		3.13	0.579+/-0.368	0.291+/-0.233	<50
11N/19W-29N01	R14C-280.14	280.14	Tejon Ranch #A7	4/17/12	15	<1.8	**20.9**	0.462+/-0.382	0.500+/-0.516	<50
11N/19W-30A01	R14C-280.14	280.14	WRM #PA-1	4/9/12	12	<1.8	**15.1**	0.583+/-0.498	0.219+/-0.320	<50
11N19W-30D01	R14C-280.14	280.14	Hein Ranch	5/8/12	7.8	<3	7.82	0.537+/-0.451	0.0607+/-0.357	<50

Name/Owner	Sample Date	Antimony ug/L	Barium mg/L	Beryllium ug/L	Cadmium ug/L	Lead ug/L	Mercury ug/L	Nickel ug/L	Selenium ug/L	Silver ug/L	Thallium ug/L	Fluoride mg/L	Boron mg/L
WRM-7 Well	4/10/12	<2	<50	<1	<1	<5	<0.4	<10	21	<10	<1	0.75	0.77
Sun Pacific #6	4/10/12	<2.0	<0.050	<1.0	<1	<5	<0.40	<10	<2	<10	<1	0.70	0.81
Sun Pacific #7	4/25/12	<2	<50	<1	<1	<5	<0.4	<10	<2	<10	<1	1.00	0.76
Sun Pacific #8	5/7/12	<2	<50	<1	<1	15	<0.4	<10	<2	<10	<1	0.90	0.79
WRM 7P-P2	3/8/12	<2	<50	<1	<1	7.5	< 0.4	<10	<2	<10	<1	0.39	0.47
Maricopa Orchards	4/10/12												
Fry	5/17/12	<2	<50	<1.0	<1	<5	<0.40	<10	<2	<10	<1	0.62	0.98
Fry	5/14/12	<2	<50	<1	<1	<5	<0.40	<10	<2	<10	<1.0	0.44	0.8
WRM #A4	3/2/12												
WRM #A4	3/7/12	<2	<50	<1	<1	10	<0.40	<10	13	<10	<1	0.25	0.62
WRM #A3	3/2/12												
WRM #A3	3/7/12	<2	<50	<1	<1	<5	<0.40	<10	6	<10	<1	0.59	0.65
WRM #A2	3/2/12												
WRM #A2	3/7/12	<2	<50	<1	<1	<5	<.40	<10	<2	<10	<1	0.61	1.1
WRM #A1	3/2/12												
WRM #A1	3/7/12	<2	<50	<1	<1	<5	<.40	<10	<2	<10	<1	0.63	1
MOC #B4 aka MOC 3012	4/11/12	<2	0.077	<1	<1	0.59	<0.4	<10	<2	<10	<1	0.43	0.27
MOC #B5	4/12/12	<2	0.092	<1	<1	69	<0.4	<10	<2	<10	<1	0.42	0.26
WRM #PB-1	3/2/12												
WRM #PB-1	3/14/12	<2	0.1	<1	<1	<5	<.40	<10	<2	<10	<1	0.43	0.3
WRM #B2	3/7/12	<2	0.088	<1	<1	<5	<0.40	<10	<2	<10	<1	0.46	0.37
WRM #B1	3/20/12	<2	0.083	<1	<1	<5	<.40	<10	<2	<10	<1	0.42	0.41
Tejon Ranch #A7	4/17/12	<2	<50	<0.1	<1	<5	<0.4	<10	7	<10	<1	0.56	1.3
WRM #PA-1	4/9/12	<2	<50	<0.1	<1	<5	<0.4	<10	<2	<10	<1	0.51	1.2
Hein Ranch	5/8/12	<2	<50	<1	<1	<5	<.4	<10	<2	<10	<1	0.60	0.74

Appendix D (Con't).

Name/Owner	Sample Date	Manganese mg/L	Sodium mg/L	Zinc mg/L	Atrazine ug/L	Bentazon ug/L	Benzene ug/L	Bromacil ug/L	Bromo-dichloro-methane ug/L	Bromoform ug/L	Carbofuran ug/L	Carbon Tetra-chloride ug/L
WRM-7 Well	4/10/12	0.013	150	<0.050	<0.5	<2	<0.5	<0.5	<0.5	<0.5	<5	<0.5
Sun Pacific #6	4/10/12	0.021	120	<0.050	<0.5	<2	<0.5	<2	<0.5	<0.5	<5	<0.5
Sun Pacific #7	4/25/12	0.015	200	<0.050	<0.5	<2	<0.5	<0.5	<0.5	<0.5	<5	<0.5
Sun Pacific #8	5/7/12	0.022	210	<0.020	<0.5	<2	<0.5	<0.5	<0.5	<0.5	<5	<0.5
WRM 7P-P2	3/8/12	0.034	390	0.072	<0.5	<2	<0.5	<0.5	<0.5	<0.5	<5	<0.5
Maricopa Orchards	4/10/12											
Fry	5/17/12	0.025	120	<0.050	<0.5	<2	<0.5	<0.5	<0.5	<0.5	<5	<0.5
Fry	5/14/12	0.051	130	<0.050	<0.5	<2	<0.5	<0.5	<0.5	<0.5	<5	<0.5
WRM #A4	3/2/12											
WRM #A4	3/7/12	<0.010	450	<0.050	<0.5	<2	<0.5	<0.5	<0.5	<0.5	<5	<0.5
WRM #A3	3/2/12											
WRM #A3	3/7/12	<0.010	94	0.16	<0.5	<2	<0.5	<0.5	<0.5	<0.5	<5	<0.5
WRM #A2	3/2/12											
WRM #A2	3/7/12	0.013	140	0.0013	<0.5	<2	<0.5	<0.5	<0.5	<0.5	<5	<0.5
WRM #A1	3/2/12											
WRM #A1	3/7/12	48.000	150	0.076	<0.5	<2	<0.5	<0.5	<0.5	<0.5	<5	<0.5
MOC #B4 aka MOC 3012	4/11/12	0.430	42	0.08	<0.5	<2	<0.5	<0.5	<0.5	<0.5	<5	<0.5
MOC #B5	4/12/12	0.040	37	0.25	<0.5	<2	<0.5	<0.5	<0.5	<0.5	<5	<0.5
WRM #PB-1	3/2/12											
WRM #PB-1	3/14/12	0.270	40	<0.05	<0.5	<2	<0.5	<0.5	<0.5	<0.5	<5	<0.5
WRM #B2	3/7/12	0.170	55	0.18	<0.5	<2	<0.5	<0.5	<0.5	<0.5	<5	<0.5
WRM #B1	3/20/12	<0.01	57	<0.05	<0.5	<2	<0.5	<0.5	<0.5	<0.5	<5	<0.5
Tejon Ranch #A7	4/17/12	0.058	170	<0.05	<0.5	<2	<0.5	<0.5	<0.5	<0.5	<5	<0.5
WRM #PA-1	4/9/12	0.013	140	<0.05	<0.5	<2	<0.5	<0.5	<0.5	<0.5	<5	<0.5
Hein Ranch	5/8/12	0.054	170	<0.05	<0.5	<2	<0.5	<0.5	<0.5	<0.5	<5	<0.5

Name/Owner	Sample Date	Chloro-methane ug/L	Chloroform ug/L	cis-1,3-Dichloro-propene ug/L	DBCP ug/L	Diazinon ug/L	1,2-Dichloro-benzene ug/L	1,3-Dichloro-benzene ug/L	1,4-Dichloro-benzene ug/L	Dichloro-methane ug/L	Dichloro-difluoro-methane ug/L
WRM-7 Well	4/10/12	<0.5	<0.5	<0.5	<0.01	<0.25	<0.5	<0.5	<0.5	<0.5	<0.5
Sun Pacific #6	4/10/12	<0.5	<0.5	<0.5	<0.01	<2	<0.5	<0.5	<0.5	<0.5	<0.5
Sun Pacific #7	4/25/12	<0.5	<0.5	<0.5	<0.01	<0.25	<0.5	<0.5	<0.5	<0.5	<0.5
Sun Pacific #8	5/7/12	<0.5	<0.5	<0.5	<0.01	<0.25	<0.5	<0.5	<0.5	<0.5	<0.5
WRM 7P-P2	3/8/12	<0.5	<0.5	<0.5	<0.01	<0.25	<0.5	<0.5	<0.5	<0.5	<0.5
Maricopa Orchards	4/10/12										
Fry	5/17/12	<0.5	<0.5	<0.5	<0.01	<0.25	<0.5	<0.5	<0.5	<0.5	<0.5
Fry	5/14/12	<0.5	<0.5	<0.5	<0.01	<0.25	<0.5	<0.5	<0.5	<0.5	<0.5
WRM #A4	3/2/12										
WRM #A4	3/7/12	<0.5	<0.5	<0.5	<0.01	<0.25	<0.5	<0.5	<0.5	<0.5	<0.5
WRM #A3	3/2/12										
WRM #A3	3/7/12	<0.5	<0.5	<0.5	<0.01	<0.25	<0.5	<0.5	<0.5	<0.5	<0.5
WRM #A2	3/2/12										
WRM #A2	3/7/12	<0.5	<0.5	<0.5	<0.01	<0.25	<0.5	<0.5	<0.5	<0.5	<0.5
WRM #A1	3/2/12										
WRM #A1	3/7/12	<0.5	<0.5	<0.5	<0.01	<0.25	<0.5	<0.5	<0.5	<0.5	<0.5
MOC #B4 aka MOC 3012	4/11/12	<0.5	<0.5	<0.5	<0.01	<0.25	<0.5	<0.5	<0.5	<0.5	<0.5
MOC #B5	4/12/12	<0.5	<0.5	<0.5	<0.01	<0.25	<0.5	<0.5	<0.5	<0.5	<0.5
WRM #PB-1	3/2/12										
WRM #PB-1	3/14/12	<0.5	<0.5	<0.5	<0.01	<0.25	<0.5	<0.5	<0.5	<0.5	<0.5
WRM #B2	3/7/12	<0.5	<0.5	<0.5	<0.01	<0.25	<0.5	<0.5	<0.5	<0.5	<0.5
WRM #B1	3/20/12	<0.5	<0.5	<0.5	<0.01	<0.25	<0.5	<0.5	<0.5	<0.5	<0.5
Tejon Ranch #A7	4/17/12	<0.5	<0.5	<0.5	<0.01	<0.25	<0.5	<0.5	<0.5	<0.5	<0.5
WRM #PA-1	4/9/12	<0.5	<0.5	<0.5	<0.01	<0.25	<0.5	<0.5	<0.5	<0.5	<0.5
Hein Ranch	5/8/12	<0.5	<0.5	<0.5	<0.01	<0.25	<0.5	<0.5	<0.5	<0.5	<0.5

Appendix D (Con't).

Name/Owner	Sample Date	1,1-Dichloro-ethane	1,2-Dichloro-ethane	1,1-Dichloro-ethylene	cis-1,2 Dichloro-ethylene	trans-1,2-Dichloro-ethylene	1,2-Dichloro-propane	1,3-Dichloropro pane	trans-1,3-Dichloro-propene	2,4,5-TP (Silvex)	2,4-D	Endrine	Ethyl-benzene
		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
WRM-7 Well	4/10/12	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5			<0.10	0.98
Sun Pacific #6	4/10/12	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<2	<0.01	<0.5
Sun Pacific #7	4/25/12	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5			<0.10	0.98
Sun Pacific #8	5/7/12	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5			<0.10	0.81
WRM 7P-P2	3/8/12	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5			<0.10	<0.5
Maricopa Orchards	4/10/12												
Fry	5/17/12	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5			<0.10	<0.5
Fry	5/14/12	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5			<0.10	<0.5
WRM #A4	3/2/12												
WRM #A4	3/7/12	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5			<0.10	<0.5
WRM #A3	3/2/12												
WRM #A3	3/7/12	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5			<0.10	<0.5
WRM #A2	3/2/12												
WRM #A2	3/7/12	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5			<0.10	<0.5
WRM #A1	3/2/12												
WRM #A1	3/7/12	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5			<0.10	<0.5
MOC #B4 aka MOC 3012	4/11/12	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5			<0.10	<0.5
MOC #B5	4/12/12	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5			<0.10	<0.5
WRM #PB-1	3/2/12												
WRM #PB-1	3/14/12	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5			<0.10	<0.5
WRM #B2	3/7/12	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5			<0.10	<0.5
WRM #B1	3/20/12	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5			<0.10	<0.5
Tejon Ranch #A7	4/17/12	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5			<0.10	<0.5
WRM #PA-1	4/9/12	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5			<0.10	<0.5
Hein Ranch	5/8/12	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5			<0.10	<0.5

Name/Owner	Sample Date	Ethylene Dibromide (EDB)	Methyl-tert-butyl ether (MTBE)	Glyphosate	Heptachlor	Heptachlor epoxide	Lindane	Methlene Chloride	Methy-oxychlor	Molinate	Chloro-benzene	bis (2-ethlhexyl) phthalate	di(2-ethlhexyl) phthalate
		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
WRM-7 Well	4/10/12	<0.02	<0.5		<0.01	<0.5	<0.2		<10	<2	<0.5	<3	
Sun Pacific #6	4/10/12	<0.02	<1	<20	<0.01	<0.01	<0.5		<0.1	<2	<0.5		
Sun Pacific #7	4/25/12	<0.02	<0.5		<0.01	<0.01	<0.2		<10	<2	<0.5	<3	
Sun Pacific #8	5/7/12	<0.02	<0.5		<0.01	<0.01	<0.2		<10	<2	<0.5	<3	
WRM 7P-P2	3/8/12	<0.02	<0.5		<0.01	<0.01	<0.2		<10	<2	<0.5	<3	
Maricopa Orchards	4/10/12												
Fry	5/17/12	<0.02	<0.5		<0.01	<0.01	<0.2		<10	<2	<0.5	<3	
Fry	5/14/12	<0.02	<0.5		<0.01	<0.01	<0.2		<10	<2	<0.5	<3	
WRM #A4	3/2/12												
WRM #A4	3/7/12	<0.02	<0.5		<0.01	<0.01	<0.2		<10	<2	<0.5	<3	
WRM #A3	3/2/12												
WRM #A3	3/7/12	<0.02	<0.5		<0.01	<0.01	<0.2		<10	<2	<0.5	<3	
WRM #A2	3/2/12												
WRM #A2	3/7/12	<0.02	<0.5		<0.01	<0.01	<0.2		<10	<2	<0.5	<3	
WRM #A1	3/2/12												
WRM #A1	3/7/12	<0.02	<0.5		<0.01	<0.01	<0.2		<10	<2	<0.5	<3	
MOC #B4 aka MOC 3012	4/11/12	<0.02	<0.5		<0.01	<0.01	<0.2		<10	<2	<0.5	<3	
MOC #B5	4/12/12	<0.02	<0.5		<0.01	<0.01	<0.2		<10	<2	<0.5	<3	
WRM #PB-1	3/2/12												
WRM #PB-1	3/14/12	<0.02	<0.5		<0.01	<0.01	<0.2		<10	<2	<0.5	<3	
WRM #B2	3/7/12	<0.02	<0.5		<0.01	<0.01	<0.2		<10	<2	<0.5	<3	
WRM #B1	3/20/12	<0.02	<0.5		<0.01	<0.01	<0.2		<10	<2	<0.5	<3	
Tejon Ranch #A7	4/17/12	<0.02	<0.5		<0.01	<0.01	<0.2		<10	<2	<0.5	<3	
WRM #PA-1	4/9/12	<0.02	<0.5		<0.01	<0.01	<0.2		<10	<2	<0.5	<3	
Hein Ranch	5/8/12	<0.02	<0.5		<0.01	<0.01	<0.2		<10	<2	<0.5	<3	

Appendix D (Con't).

Name/Owner	Sample Date	Prometryn ug/L	Styrene ug/L	Tetra-chloro-ethylene (PCE) ug/L	Thiobencarb ug/L	1,2,4-Trichloro-benzene ug/L	Toluene ug/L	Trihalo-methanes Total ug/L	1,1,2,2-Tetrachloro-ethane ug/L	1,1,1-Trichloro-ethane ug/L	1,1,2-Trichloro-ethane ug/L	Toxaphene ug/L
WRM-7 Well	4/10/12	<2	1.4	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
Sun Pacific #6	4/10/12	<2	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
Sun Pacific #7	4/25/12	<2	1.4	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
Sun Pacific #8	5/7/12	<2	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
WRM 7P-P2	3/8/12		<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
Maricopa Orchards	4/10/12											
Fry	5/17/12	<2	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
Fry	5/14/12	<2	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
WRM #A4	3/2/12											
WRM #A4	3/7/12		<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
WRM #A3	3/2/12											
WRM #A3	3/7/12		<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
WRM #A2	3/2/12											
WRM #A2	3/7/12		<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
WRM #A1	3/2/12											
WRM #A1	3/7/12		<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
MOC #B4 aka MOC 3012	4/11/12	<2	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
MOC #B5	4/12/12	<2	0.67	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
WRM #PB-1	3/2/12											
WRM #PB-1	3/14/12	<2	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
WRM #B2	3/7/12		<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
WRM #B1	3/20/12	<2	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
Tejon Ranch #A7	4/17/12	<2	0.67	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
WRM #PA-1	4/9/12	<2	0.67	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
Hein Ranch	5/8/12	<2	0.67	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	

Name/Owner	Sample Date	Trichlorofluoro-methane (freon 11) ug/L	Trichlorotrifluoro-methane (freon 113) ug/L	Vinyl Chloride ug/L	Total Xylenes ug/L	Fecal Coliform MPN	Coliform bacteria MPN
WRM-7 Well	4/10/12			<0.5	<0.5	<1.1	<1.1
Sun Pacific #6	4/10/12	<0.5	<0.5	<0.5	<0.5	<1	<1
Sun Pacific #7	4/25/12			<0.5	<0.5	<1.1	<1.1
Sun Pacific #8	5/7/12			<0.5	<0.5	<1.1	<1.1
WRM 7P-P2	3/8/12			<0.5	<0.5	<1.1	6.9
Maricopa Orchards	4/10/12						
Fry	5/17/12			<0.5	<0.5	<1.1	<1.1
Fry	5/14/12			<0.5	<0.5	<1.1	<1.1
WRM #A4	3/2/12						
WRM #A4	3/7/12			<0.5	<0.5	<1.1	<1.1
WRM #A3	3/2/12						
WRM #A3	3/7/12			<0.5	<0.5	<1.1	<1.1
WRM #A2	3/2/12						
WRM #A2	3/7/12			<0.5	<0.5	<1.1	6.9
WRM #A1	3/2/12						
WRM #A1	3/7/12			<0.5	<0.5	<1.1	1.1
MOC #B4 aka MOC 3012	4/11/12			<0.5	<0.5	<1.1	<1.1
MOC #B5	4/12/12			<0.5	<0.5	2.2	23
WRM #PB-1	3/2/12						
WRM #PB-1	3/14/12			<0.5	<0.5	<1.1	1.1
WRM #B2	3/7/12			<0.5	<0.5	<1.1	1.1
WRM #B1	3/20/12			<0.5	<0.5	<1.1	1.1
Tejon Ranch #A7	4/17/12			<0.5	<0.5	<1.1	<1.1
WRM #PA-1	4/9/12			<0.5	<0.5	<1.1	6.9
Hein Ranch	5/8/12			<0.5	<0.5	<1.1	5.1

Appendix E. Constituents-of-concern in the California Aqueduct Upstream and Downstream of the Turn-ins (mg/L unless specified)

Station Name	Station Number	Sample Date	Arsenic	Bromide	Conductivity (µS/cm)	Total Chromium	Dissolved Organic Carbon	Nitrate	Sulfate	Total Dissolved Solids	Total Organic Carbon
Check 21	KA017226	1/17/12	0.002	0.34	630	<0.001	8.9	3.8	45	347	3.6
Check 21	KA017226	2/14/12	0.002	0.34	585	<0.001	4.3	4.0	42	324	4.3
Check 21	KA017226	3/20/12	0.002	0.28	513	<0.001	5.1	3.4	48	295	5.3
Check 21	KA017226	4/17/12	0.002	0.21	514	<0.001	4.6	3.4	53	296	4.6
Check 21	KA017226	5/15/12	0.002	0.19	420	<0.001	2.6	2.0	36	235	2.6
Check 21	KA017226	6/19/12	0.002	0.20	426	<0.001	2.7	1.8	35	236	2.7
Check 21	KA017226	7/17/12	0.002	0.13	371	<0.001	3.6	1.0	27	196	3.6
Check 21	KA017226	8/14/12	0.002	0.15	331	<0.001	2.8	0.3	16	183	2.8
Check 27	KA023173	3/5/12	0.001	0.20	464		3.8	2.4	37	256	
Check 27	KA023173	3/22/12	0.002	0.21	435		3.8	1.6	36	241	
Check 27	KA023173	4/3/12	0.002	0.26	556		4.7	2.3	50	308	
Check 27	KA023173	4/17/12	0.002	0.24	633		5.7	5.0	68	356	
Check 27	KA023173	4/30/12	0.002	0.24	539		4.3	3.3	57	309	
Check 27	KA023173	6/4/12	0.002	0.22	428		2.5	1.8	36	242	
Check 27	KA023173	6/18/12	0.002	0.21	432		3.4	2.0	35	240	
CHECK 29	KA024454	1/18/12	0.002	0.31	586	<0.001	3.7	3.2	43	322	8.2
CHECK 29	KA024454	2/16/12	0.002	0.30	597	<0.001	4.1	4.0	45	330	3.9
CHECK 29	KA024454	3/5/12	0.002	0.20	473		3.6	4.0	40	263	
CHECK 29	KA024454	3/21/12	0.002	0.21	445	0.001	2.3	5.0	41	246	2.4
CHECK 29	KA024454	3/22/12	0.002	0.21	435		3.2	3.2	39	242	
CHECK 29	KA024454	4/3/12	0.003	0.24	499		3.7	3.6	48	276	
CHECK 29	KA024454	4/17/12	0.002	0.23	560	<0.001	4.7	5.1	60	320	4.6
CHECK 29	KA024454	4/17/12	0.003	0.23	561		4.4	5.2	60	318	
CHECK 29	KA024454	4/30/12	0.002	0.24	515	<0.001	3.5	3.7	56	302	
CHECK 29	KA024454	5/15/12	0.002	0.22	455	<0.001	2.6	<0.1	42	251	
CHECK 29	KA024454	5/15/12	0.002	0.18	452	<0.001	2.8	2.5	41	253	2.8
CHECK 29	KA024454	6/4/12	0.002	0.22	430	<0.001	2.1	2.6	39	237	
CHECK 29	KA024454	6/18/12	0.002	0.17	417	<0.001	2.6	2.4	36	230	2.6
CHECK 29	KA024454	6/18/12	0.002	0.17	417	<0.001	3.2	2.3	36	229	
CHECK 29	KA024454	7/16/12	0.002	0.13	350	<0.001	3.4	1.2	24	192	3.7
CHECK 29	KA024454	8/14/12	0.002	0.16	344	<0.001	2.6	0.3	17	190	2.8
Check 39	KA029021	3/5/12	0.002	0.23	485		3.4	2.6	37	267	
Check 39	KA029021	3/22/12	0.003	0.21	444		3.0	3.6	39	245	
Check 39	KA029021	4/3/12	0.003	0.19	438		2.6	4.5	43	248	
Check 39	KA029021	4/17/12	0.003	0.22	589		4.4	5.8	66	338	
Check 39	KA029021	4/30/12	0.002	0.24	550	<0.001	3.8	4.4	62	315	
Check 39	KA029021	5/15/12	0.002	0.18	447	<0.001	1.8	2.4	40	246	
CHECK 41	KA030341	1/18/12	0.001	0.30	541	<0.001	3.2	2.9	38	307	3.4
CHECK 41	KA030341	2/15/12	0.002	0.32	618	<0.001	3.9	3.8	44	341	4.1
CHECK 41	KA030341	3/21/12	0.002	0.18	421	0.001	2.8	3.8	36	233	3.0
CHECK 41	KA030341	4/18/12	0.003	0.24	540	0.001	4.5	6.4	58	307	4.4
CHECK 41	KA030341	5/16/12	0.002	0.18	449	<0.001	2.8	2.6	44	274	2.9
CHECK 41	KA030341	6/20/12	0.002	0.17	409	<0.001	2.4	2.4	38	242	2.5
CHECK 41	KA030341	7/18/12	0.002	0.16	363	<0.001	3.5	1.4	27	203	3.7
CHECK 41	KA030341	8/14/12	0.002	0.22	347	<0.001	3.4	0.4	18	192	3.4

Appendix F. Detailed Turn-in Water Quality Data for KWBC, December 2012, DWR

Analyte	12/12/2012 KWBC	Rpt. Limit	Units	Method
Conductance (EC)	474	1	µS/cm	Std Method 2510-B
Dissolved Aluminum	< .01	0.01	mg/L	EPA 200.8 (D)
Dissolved Ammonia	< .01	0.01	mg/L as N	EPA 350.1
Dissolved Antimony	< .001	0.001	mg/L	EPA 200.8 (D)
Dissolved Arsenic	0.002	0.001	mg/L	EPA 200.8 (D)
Dissolved Barium	0.049	0.005	mg/L	EPA 200.8 (D)
Dissolved Beryllium	< .001	0.001	mg/L	EPA 200.8 (D)
Dissolved Boron	0.246	0.1	mg/L	EPA 200.7 (D)
Dissolved Bromide	0.2	0.01	mg/L	EPA 300.0 28d Hold
Dissolved Cadmium	< .001	0.001	mg/L	EPA 200.8 (D)
Dissolved Calcium	47.4	1	mg/L	EPA 200.7 (D)
Dissolved Chloride	52	1	mg/L	EPA 300.0 28d Hold
Dissolved Chromium	0.001	0.001	mg/L	EPA 200.8 (D)
Dissolved Chromium (+6) a/	0.00098	0.00003	mg/L	EPA 218.6 (D)
Dissolved Chromium (+6) a/	0.00098	0.00003	mg/L	EPA 218.6 (D)
Dissolved Chromium (+6) a/	0.00095	0.00003	mg/L	EPA 218.6 (D)
Dissolved Copper	< .001	0.001	mg/L	EPA 200.8 (D)
Dissolved Hardness	124	1	mg/L as CaCO3	Std Method 2340 B
Dissolved Iron	< .005	0.005	mg/L	EPA 200.8 (D)
Dissolved Lead	< .001	0.001	mg/L	EPA 200.8 (D)
Dissolved Magnesium	1.45	1	mg/L	EPA 200.7 (D)
Dissolved Manganese	< .005	0.005	mg/L	EPA 200.8 (D)
Dissolved Mercury	< .0002	0.0002	mg/L	EPA 200.8 (Hg Dissolved)
Dissolved Nickel	< .001	0.001	mg/L	EPA 200.8 (D)
Dissolved Nitrate	7.8	0.1	mg/L	EPA 300.0 28d Hold
Dissolved Nitrate + Nitrite	1.4	0.01	mg/L as N	Std Method 4500-NO3-F (
Dissolved Organic Carbon	< .5	0.5	mg/L as C	EPA 415.1 (D) Ox
Dissolved Organic Carbon	< .5	0.5	mg/L as C	EPA 415.1 (D) Ox
Dissolved Ortho-phosphate	< .01	0.01	mg/L as P	EPA 365.1 (DWR Modified)
Dissolved Selenium	0.001	0.001	mg/L	EPA 200.8 (D)
Dissolved Silver	< .001	0.001	mg/L	EPA 200.8 (D)
Dissolved Sodium	50	1	mg/L	EPA 200.7 (D)
Dissolved Sulfate	50	1	mg/L	EPA 300.0 28d Hold
Dissolved Zinc	< .005	0.005	mg/L	EPA 200.8 (D)
pH	7.8	0.1	pH Units	Std Method 2320 B
Total Alkalinity	93	1	mg/L as CaCO3	Std Method 2320 B
Total Aluminum	0.084	0.01	mg/L	EPA 200.8 (T)
Total Antimony	< .001	0.001	mg/L	EPA 200.8 (T)
Total Arsenic	0.002	0.001	mg/L	EPA 200.8 (T)
Total Barium	0.052	0.005	mg/L	EPA 200.8 (T)
Total Beryllium	< .001	0.001	mg/L	EPA 200.8 (T)
Total Cadmium	< .001	0.001	mg/L	EPA 200.8 (T)
Total Chromium	0.001	0.001	mg/L	EPA 200.8 (T)
Total Copper	< .001	0.001	mg/L	EPA 200.8 (T)
Total Dissolved Solids	265	1	mg/L	Std Method 2540 C
Total Iron	0.116	0.005	mg/L	EPA 200.8 (T)
Total Kjeldahl Nitrogen	< .1	0.1	mg/L as N	EPA 351.2
Total Lead	< .001	0.001	mg/L	EPA 200.8 (T)
Total Manganese	0.005	0.005	mg/L	EPA 200.8 (T)
Total Nickel	< .001	0.001	mg/L	EPA 200.8 (T)
Total Organic Carbon	< .5	0.5	mg/L as C	EPA 415.1 (T) Ox
Total Organic Carbon	< .5	0.5	mg/L as C	EPA 415.1 (T) Ox
Total Phosphorus	< .01	0.01	mg/L	EPA 365.4
Total Selenium	0.001	0.001	mg/L	EPA 200.8 (T)
Total Silver	< .001	0.001	mg/L	EPA 200.8 (T)
Total Zinc	0.005	0.005	mg/L	EPA 200.8 (T)

a/ Analysis by Weck Laboratories Inc., City of Industry, CA

Appendix G. Detailed Turn-in Water Quality Data for KWBC, December 2012, KCWA

Analyte (12/11/2012)	KWBC	Units
Nitrate	8.1	mg/L
Sulfate	48	mg/L
Total Dissolved Solids	290	mg/L
Total Organic Carbon	0.85	mg/L
Arsenic a/	0.94	µg/L
Hexavalent Chromium	0.82	µg/L
Bromide	0.22	µg/L
Gross Alpha	<2.85+/- 0.156	pC/L
Chloride	53	mg/L
Orthophosphate	<0.012	mg/L

a/ Lab sheet states total recoverable

Appendix H. Detailed Turn-in Water Quality Data for GKA07967r, DWR

Analyte (8/22/2012)	GKA07967r	Rpt. Limt	Units	Methods
Conductance (EC)	1575	1.	µS/cm	Std Method 2510-B
Conductance (EC)	1541	1.	µS/cm	Std Method 2510-B
Dissolved Aluminum	< .01	0.01	mg/L	EPA 200.8 (D)
Dissolved Antimony	< .001	0.001	mg/L	EPA 200.8 (D)
Dissolved Arsenic	0.006	0.001	mg/L	EPA 200.8 (D)
Dissolved Barium	0.067	0.005	mg/L	EPA 200.8 (D)
Dissolved Beryllium	< .001	0.001	mg/L	EPA 200.8 (D)
Dissolved Boron	1.4	0.1	mg/L	EPA 200.7 (D)
Dissolved Bromide	1.5	0.01	mg/L	EPA 300.0 28d Hold
Dissolved Bromide	1.5	0.01	mg/L	EPA 300.0 28d Hold
Dissolved Cadmium	< .001	0.001	mg/L	EPA 200.8 (D)
Dissolved Calcium	54	1.	mg/L	EPA 200.7 (D)
Dissolved Chloride	304	5.	mg/L	EPA 300.0 28d Hold
Dissolved Chloride	306	5.	mg/L	EPA 300.0 28d Hold
Dissolved Chromium	0.003	0.001	mg/L	EPA 200.8 (D)
Dissolved Copper	0.004	0.001	mg/L	EPA 200.8 (D)
Dissolved Hardness	252	1.	mg/L as CaCO3	Std Method 2340 B
Dissolved Iron	0.038	0.005	mg/L	EPA 200.8 (D)
Dissolved Lead	< .001	0.001	mg/L	EPA 200.8 (D)
Dissolved Magnesium	29	1.	mg/L	EPA 200.7 (D)
Dissolved Manganese	< .005	0.005	mg/L	EPA 200.8 (D)
Dissolved Mercury	< .0002	0.0002	mg/L	EPA 200.8 (Hg Dissolved)
Dissolved Nickel	0.001	0.001	mg/L	EPA 200.8 (D)
Dissolved Nitrate	8.5	0.1	mg/L	EPA 300.0 28d Hold
Dissolved Nitrate	8.5	0.1	mg/L	EPA 300.0 28d Hold
Dissolved Organic Carbon	< .5	0.5	mg/L as C	EPA 415.1 (D) Ox
Dissolved Potassium	3.7	0.5	mg/L	EPA 200.7 (D)
Dissolved Selenium	0.004	0.001	mg/L	EPA 200.8 (D)
Dissolved Silver	< .001	0.001	mg/L	EPA 200.8 (D)
Dissolved Sodium	209	1.	mg/L	EPA 200.7 (D)
Dissolved Sulfate	110	5.	mg/L	EPA 300.0 28d Hold
Dissolved Sulfate	110	5.	mg/L	EPA 300.0 28d Hold
Dissolved Zinc	0.012	0.005	mg/L	EPA 200.8 (D)
pH	7.9	0.1	pH Units	Std Method 2320 B
pH	7.9	0.1	pH Units	Std Method 2320 B
Total Alkalinity	179	1.	mg/L as CaCO3	Std Method 2320 B
Total Alkalinity	178	1.	mg/L as CaCO3	Std Method 2320 B
Total Dissolved Solids	876	1.	mg/L	Std Method 2540 C
Total Dissolved Solids	875	1.	mg/L	Std Method 2540 C
Total Organic Carbon	0.9	0.5	mg/L as C	EPA 415.1 (T) Ox
Turbidity.	<1	1	NTU	EPA 180.1

Appendix I. Detailed Turn-in Water Quality Data for GKA07967r, SLWD (Sampled at wellhead on 8/3/2012, analysis by BSK Labs, Fresno, CA)

General Chemistry

Analyte	Method	Result	RL	Units	RL Mult	Batch	Prepared	Analyzed	Qual
*Aggressive Index		12				A208777	08/09/12	08/09/12	
Alkalinity as CaC03	SM 2320 B	180	3.0	mg/L	1	A208506	08/03/12	08/03/12	
Bicarbonate as CaC03	SM 2320 B	180	3.0	mg/L	1	A208506	08/03/12	08/03/12	
Carbonate as CaCO3	SM 2320 B	ND	3.0	mg/L	1	A208506	08/03/12	08/03/12	
Hydroxide as CaCO3	SM 2320 B	ND	3.0	mg/L	1	A208506	08/03/12	08/03/12	
Bromide	EPA 300.1	14	0.050	mg/L	10	A208746	08/09/12	08/09/12	
Surroga e O ch oroace a e	EPA 300.1	109 %	Accep ab e range	90-115 %					
Chloride	EPA 300.0	320	5.0	mg/L	5	A208556	08/06/12	08/06/12	
Conductivity @ 25C	SM 2510 B	1400	1.0	umhos/cm	1	A208506	08/03/12	08/03/12	
Fluoride	SM 4500-F C	0.23	0.10	mg/L	1	A208884	08/13/12	08/13/12	
Langelier Index	SM 2330 B	0.46				A209027	08/15/12	08/15/12	
MBAS, Calculated as LAS, mol wt 340	SM 5540 C	ND	0.050	mg/L	1	A208507	08/03/12 14:55	08/03/12 14:55	
Nitrate as N03	EPA 300.0	8.0	3.0	mg/L	3	A208492	08/03/12 18:15	08/03/12 18:15	
Nitrite as N	EPA 300.0	ND	0.15	mg/L	3	A208492	08/03/12 18:15	08/03/12 18:15	DL01
pH (1)	SM 4500-H+ B	8.1		pH Units	1	A208506	08/03/12	08/03/12	
pH Temperature in oC		22.5							
Sulfate as S04	EPA 300.0	110	6.0	mg/L	3	A208492	08/03/12	08/03/12	
Total Dissolved Solids	SM 2540C	840	5.0	mg/L	1	A208686	08/08/12	08/14/12	
Total Organic Carbon	SM 5310 C	ND	0.20	mg/L	1	A208781	08/09/12	08/09/12	

Metals

Analyte	Method	Result	RL	Units	RL Mult	Batch	Prepared	Analyzed	Qual
Aluminum	EPA 200.7	ND	0.050	mg/L	1	A208560	08/06/12	08/08/12	
Antimony	EPA 200.8	ND	2.0	ug/L	1	A208560	08/06/12	08/10/12	
Arsenic	EPA 200.8	3.9	2.0	ug/L	1	A208560	08/06/12	08/10/12	
Barium	EPA 200.7	0.071	0.050	mg/L	1	A208560	08/06/12	08/08/12	
Beryllium	EPA 200.8	ND	1.0	ug/L	1	A208560	08/06/12	08/10/12	
*Boron	EPA 200.7	1.3	0.10	mg/L	1	A208560	08/06/12	08/08/12	
Cadmium	EPA 200.8	ND	1.0	ug/L	1	A208560	08/06/12	08/10/12	
Calcium	EPA 200.7	49	0.10	mg/L	1	A208560	08/06/12	08/08/12	
Chromium	EPA 200.8	ND	10	ug/L	1	A208560	08/06/12	08/10/12	
Copper	EPA 200.7	ND	0.050	mg/L	1	A208560	08/06/12	08/08/12	
Hardness as CaC03		230	0.41	mg/L					
Iron	EPA 200.7	0.076	0.030	mg/L	1	A208560	08/06/12	08/08/12	
Lead	EPA 200.8	ND	5.0	ug/L	1	A208560	08/06/12	08/10/12	
Magnesium	EPA 200.7	27	0.10	mg/L	1	A208560	08/06/12	08/08/12	
Manganese	EPA 200.7	ND	0.010	mg/L	1	A208560	08/06/12	08/08/12	
Mercury	EPA 200.8	ND	0.40	ug/L	1	A208560	08/06/12	08/10/12	
Nickel	EPA 200.8	ND	10	ug/L	1	A208560	08/06/12	08/10/12	
Potassium	EPA 200.7	2.2	2.0	mg/L	1	A208560	08/06/12	08/08/12	
Selenium	EPA 200.8	4.5	2.0	ug/L	1	A208560	08/06/12	08/10/12	
Silver	EPA 200.7	ND	0.010	mg/L	1	A208560	08/06/12	08/08/12	
Sodium	EPA 200.7	200	1.0	mg/L	1	A208560	08/06/12	08/08/12	
Thallium	EPA 200.8	ND	1.0	ug/L	1	A208560	08/06/12	08/10/12	
Zinc	EPA 200.7	ND	0.050	mg/L	1	A208560	08/06/12	08/08/12	

Radiological

Analyte	Method	Result	Units	Batch	Prepared	Analyzed	Qual
*Gross Alpha	EPA 00-02	2.22	pCi/L	A208662	08/08/12	08/09/12	
*1.65 Sigma Uncertainty		0.269	±				
*MDA95		1.16	pCi/L				

0rganics

Analyte	Method	Result	RL	Units	RL Mult	Batch	Prepared	Analyzed	Qual
EDB and DBCP by GC-ECD									
Dibromochloropropane (DBCP)	EPA 504.1	ND	0.010	ug/L	1	A208855	08/11/12	08/12/12	
Ethylene Dibromide (EDB)	EPA 504.1	ND	0.020	ug/L	1	A208855	08/11/12	08/12/12	
Surroga e Bromoform	EPA 504.1	102 %		Accep ab e range	70-130 %				
0rganohalide Pesticides and PCBs by GC-ECD									
Aldrin	EPA 505	ND	0.075	ug/L	1	A208548	08/06/12	08/06/12	
Chlordane	EPA 505	ND	0.10	ug/L	1	A208548	08/06/12	08/06/12	
Chlorothalonil	EPA 505	ND	5.0	ug/L	1	A208548	08/06/12	08/06/12	
Dieldrin	EPA 505	ND	0.020	ug/L	1	A208548	08/06/12	08/06/12	
Endrin	EPA 505	ND	0.10	ug/L	1	A208548	08/06/12	08/06/12	
Heptachlor	EPA 505	ND	0.010	ug/L	1	A208548	08/06/12	08/06/12	
Heptachlor Epoxide	EPA 505	ND	0.010	ug/L	1	A208548	08/06/12	08/06/12	
Hexachlorobenzene	EPA 505	ND	0.50	ug/L	1	A208548	08/06/12	08/06/12	
Hexachlorocyclopentadiene	EPA 505	ND	1.0	ug/L	1	A208548	08/06/12	08/06/12	
Lindane	EPA 505	ND	0.20	ug/L	1	A208548	08/06/12	08/06/12	
Methoxychlor	EPA 505	ND	10	ug/L	1	A208548	08/06/12	08/06/12	
PCB Aroclor Screen	EPA 505	ND	0.50	ug/L	1	A208548	08/06/12	08/06/12	
Toxaphene	EPA 505	ND	1.0	ug/L	1	A208548	08/06/12	08/06/12	
Trifluralin	EPA 505	ND	1.0	ug/L	1	A208548	08/06/12	08/06/12	
Surroga e TCMX	EPA 505	103 %		Accep ab e range	70-130 %				

Appendix I (Con't).

Analyte	Method	Result	RL	Units	RL Mult	Batch	Prepared	Analyzed	Qual
Chlorinated Acid Herbicides by GC-ECD									
2,4,5-T	EPA 515.3	ND	10	ug/L	1	A208618	08/07/12	08/09/12	
2,4,5-TP (Silvex)	EPA 515.3	ND	10	ug/L	1	A208618	08/07/12	08/09/12	
2,4-D	EPA 515.3	ND	10	ug/L	1	A208618	08/07/12	08/09/12	
Bentazon	EPA 515.3	ND	2.0	ug/L	1	A208618	08/07/12	08/09/12	
Dalapon	EPA 515.3	ND	10	ug/L	1	A208618	08/07/12	08/09/12	
Dicamba	EPA 515.3	ND	15	ug/L	1	A208618	08/07/12	08/09/12	
Dinoseb	EPA 515.3	ND	2.0	ug/L	1	A208618	08/07/12	08/09/12	
Pentachlorophenol	EPA 515.3	ND	0.20	ug/L	1	A208618	08/07/12	08/09/12	
Picloram	EPA 515.3	ND	10	ug/L	1	A208618	08/07/12	08/09/12	

Surroga e OCPAA
EPA 515.3
98 %
Accep ab e range 70-130 %

Analyte	Method	Result	RL	Units	RL Mult	Batch	Prepared	Analyzed	Qual
Semi-Volatile 0rganics by GC-MS	EPA 525.2	ND	10	ug/L	1	A208600	08/07/12	08/08/12	
Atrazine	EPA 525.2	ND	0.50	ug/L	1	A208600	08/07/12	08/08/12	
Benzo(a)pyrene	EPA 525.2	ND	0.10	ug/L	1	A208600	08/07/12	08/08/12	
Bis(2-ethylhexyl) adipate	EPA 525.2	ND	3.0	ug/L	1	A208600	08/07/12	08/08/12	
Bis(2-ethylhexyl) phthalate	EPA 525.2	ND	3.0	ug/L	1	A208600	08/07/12	08/08/12	
Bromacil	EPA 525.2	ND	10	ug/L	1	A208600	08/07/12	08/08/12	
Butachlor	EPA 525.2	ND	0.38	ug/L	1	A208600	08/07/12	08/08/12	
*Chlorpyrifos	EPA 525.2	ND	10	ug/L	1	A208600	08/07/12	08/08/12	
Diazinon	EPA 525.2	ND	0.25	ug/L	1	A208600	08/07/12	08/08/12	
Dimethoate	EPA 525.2	ND	10	ug/L	1	A208600	08/07/12	08/08/12	
Metolachlor	EPA 525.2	ND	0.50	ug/L	1	A208600	08/07/12	08/08/12	
Metribuzin	EPA 525.2	ND	0.50	ug/L	1	A208600	08/07/12	08/08/12	
Molinate	EPA 525.2	ND	2.0	ug/L	1	A208600	08/07/12	08/08/12	
Propachlor	EPA 525.2	ND	0.50	ug/L	1	A208600	08/07/12	08/08/12	
Simazine	EPA 525.2	ND	10	ug/L	1	A208600	08/07/12	08/08/12	
Thiobencarb	EPA 525.2	ND	10	ug/L	1	A208600	08/07/12	08/08/12	

Surroga e
1,3-O me hy -2-n robenzene
EPA 525.2
100 %
Accep ab e range 70-130 %

Sample Description:

Analyte	Method	Result	RL	Units	RL Mult	Batch	Prepared	Analyzed	Qual
Carbamates by HPLC									
3-Hydroxycarbofuran	EPA 5311	ND	3.0	ug/L	1	A208692	08/08/12	08/08/12	
Aldicarb	EPA 5311	ND	3.0	ug/L	1	A208692	08/08/12	08/08/12	
Aldicarb Sulfone	EPA 5311	ND	2.0	ug/L	1	A208692	08/08/12	08/08/12	
Aldicarb Sulfoxide	EPA 5311	ND	3.0	ug/L	1	A208692	08/08/12	08/08/12	
Carbaryl	EPA 5311	ND	5.0	ug/L	1	A208692	08/08/12	08/08/12	
Carbofuran	EPA 5311	ND	5.0	ug/L	1	A208692	08/08/12	08/08/12	
Methomyl	EPA 5311	ND	2.0	ug/L	1	A208692	08/08/12	08/08/12	
Oxamyl	EPA 5311	ND	20	ug/L	1	A208692	08/08/12	08/08/12	
Glyphosate by HPLC									
Glyphosate	EPA 547	ND	25	ug/L	1	A208775	08/09/12	08/09/12	
Surroga e AMPA	EPA 547	101%	Accep ab e range 70-130 %						
Endothall by GC-MS									
Endothall	EPA 548.1	ND	45	ug/L	1	A208593	08/06/12	08/07/12	
Diquat by HPLC									
Diquat	EPA 549.2	ND	4.0	ug/L	1	A208591	08/06/12	08/08/12	

Appendix J. Detailed Turn-in Water Quality Data for GKA11543, DWR

Method (1/3/13)	Analyte	Rpt. Lmt.	Units	Method
Conductance (EC)	685	1.	µS/cm	Std Method 2510-B
Dissolved Ammonia	0.01	0.01	mg/L as N	EPA 350.1
Dissolved Arsenic	0.001	0.001	mg/L	EPA 200.8 (D)
Dissolved Boron	0.356	0.1	mg/L	EPA 200.7 (D)
Dissolved Bromide	0.32	0.01	mg/L	EPA 300.0 28d Hold
Dissolved Calcium	34.1	1.	mg/L	EPA 200.7 (D)
Dissolved Chloride	90	1.	mg/L	EPA 300.0 28d Hold
Dissolved Chromium	< .001	0.001	mg/L	EPA 200.8 (D)
Dissolved Copper	0.002	0.001	mg/L	EPA 200.8 (D)
Dissolved Hardness	159	1.	mg/L as CaCO3	Std Method 2340 B
Dissolved Iron	< .005	0.005	mg/L	EPA 200.8 (D)
Dissolved Lead	< .001	0.001	mg/L	EPA 200.8 (D)
Dissolved Magnesium	17.9	1.	mg/L	EPA 200.7 (D)
Dissolved Manganese	< .005	0.005	mg/L	EPA 200.8 (D)
Dissolved Nitrate	2.4	0.1	mg/L	EPA 300.0 28d Hold
Dissolved Nitrate + Nitrite	0.56	0.01	mg/L as N	Std Method 4500-NO3 F (28 day)
Dissolved Organic Carbon	2.9	0.5	mg/L as C	EPA 415.1 (D) Ox
Dissolved Ortho-phosphate	0.01	0.01	mg/L as P	EPA 365.1 (DWR Modified)
Dissolved Selenium	0.002	0.001	mg/L	EPA 200.8 (D)
Dissolved Sodium	82.5	1.	mg/L	EPA 200.7 (D)
Dissolved Sulfate	98	1.	mg/L	EPA 300.0 28d Hold
Dissolved Zinc	< .005	0.005	mg/L	EPA 200.8 (D)
pH	7.7	0.1	pH Units	Std Method 2320 B
Total Alkalinity	84	1.	mg/L as CaCO3	Std Method 2320 B
Total Dissolved Solids	398	1.	mg/L	Std Method 2540 C
Total Dissolved Solids	399	1.	mg/L	Std Method 2540 C
Total Kjeldahl Nitrogen	0.5	0.1	mg/L as N	EPA 351.2
Total Kjeldahl Nitrogen	0.6	0.1	mg/L as N	EPA 351.2
Total Organic Carbon	2.9	0.5	mg/L as C	EPA 415.1 (T) Ox
Total Phosphorus	0.05	0.01	mg/L	EPA 365.4
Total Phosphorus	0.06	0.01	mg/L	EPA 365.4
Total Suspended Solids	44	1.	mg/L	EPA 160.2
Total Suspended Solids	44	1.	mg/L	EPA 160.2
Turbidity	27	1.	N.T.U.	EPA 180.1
Turbidity	27	1.	N.T.U.	EPA 180.1
Volatile Suspended Solids	5	1.	mg/L	EPA 160.4
Volatile Suspended Solids	5	1.	mg/L	EPA 160.4